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The volcano's deadly work, from the fall



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A VIEW OF ST. PIERRE, WITH MOUNT PELEE IN THE BACKGROUND

This is one of the finest views in the town, showing the character of its houses and its principal street, from which can be readily understood the character of the destruction which befell the city.

THE VOLCANO'S DEADLY WORK

FROM THE FALL OF POMPEII TO THE
DESTRUCTION OF ST. PIERRE

WITH A FULL EXPLANATION IN LANGUAGE
EASILY UNDERSTOOD OF THE CAUSES WHICH
LEAD UP TO THESE MOST DISASTROUS AND

DESTRUCTIVE UPHEAVALS OF NATURE

A VIVID AND ACCURATE STORY OF THE AWFUL
CALAMITY WHICH VISITED THE ISLANDS OF
MARTINIQUE AND ST. VINCENT, MAY 8, 1902,
AS TOLD BY EYE-WITNESSES AND

BY OUR SPECIAL REPRESENTATIVE

GENERAL SAMUEL A. McALISTER

Consul of the United States at Barbados

EDITED AND WRITTEN BY

CHARLES MORRIS, LL.D.

Member of the Geographical Society of Philadelphia and of the Academy of Natural Sciences
and Author of many Valuable Treatises on Physical Phenomena

PROFUSELY ILLUSTRATED WITH NUMEROUS PHOTOGRAPHIC
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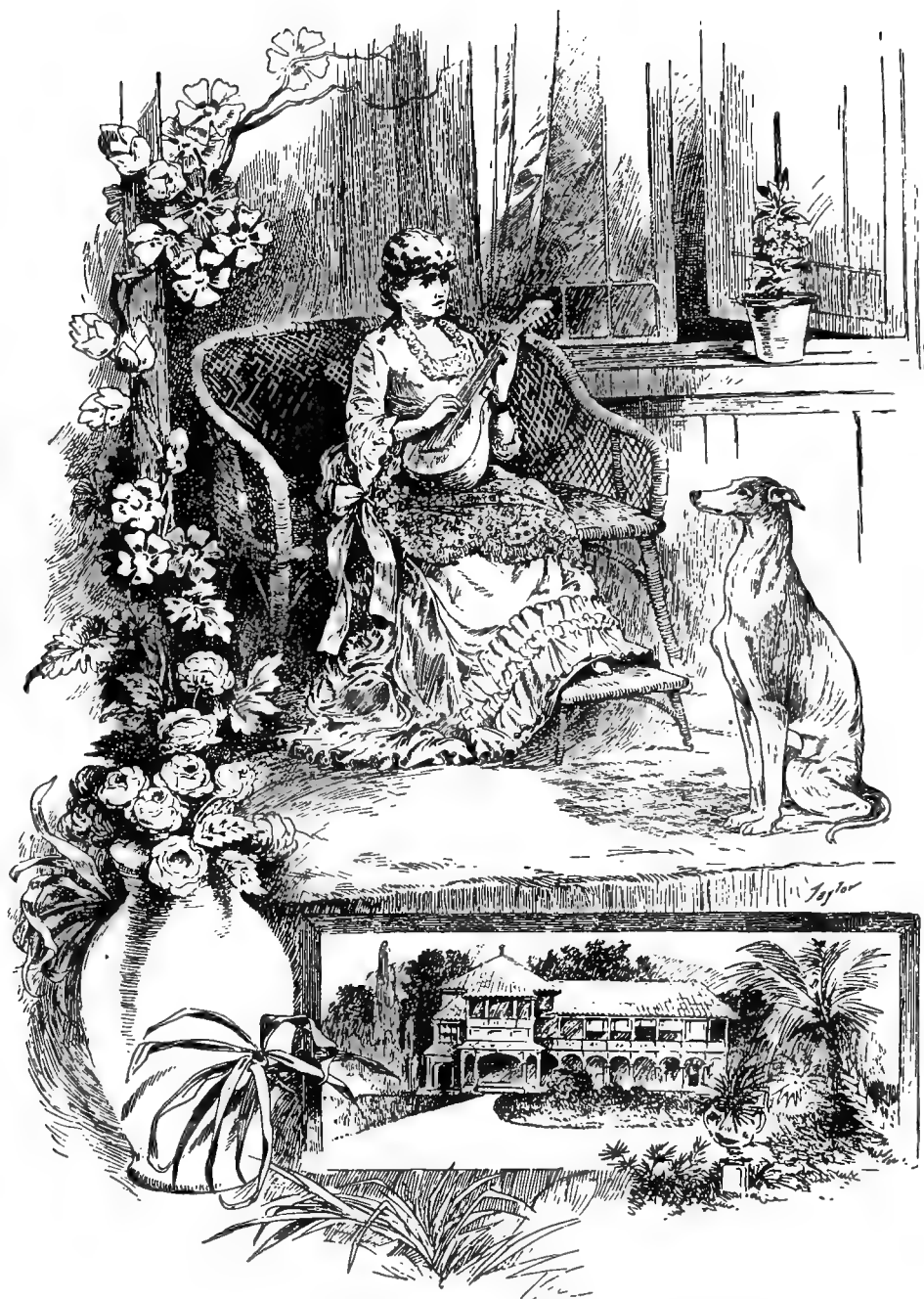
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GREAT HISTORICAL DISASTERS

BY

VOLCANO AND EARTHQUAKE

- B.C. 285—Japan, earthquake, 800 square miles engulfed, volcanic mountain formed.
- A.D. 63—Italy, earthquake, Pompeii and Herculaneum partly destroyed, large numbers killed.
- A.D. 79—Italy, volcanic eruption of Vesuvius. Pompeii and Herculaneum buried. Most of their people killed.
- A.D. 526—Antioch, earthquake, 250,000 killed.
- A.D. 893—India, earthquake, 180,000 killed.
- 1139—Persia, earthquake, 100,000 killed.
- 1170—Sicily and Calabria, earthquake, 15,000 killed.
- 1456—Kingdom of Naples, earthquake, 60,000 killed.
- 1531—Lisbon, earthquake, 30,000 killed.
- 1693—Sicily, earthquake, 93,000 killed.
- 1703—Yeddo, earthquake, 190,000 killed.
- 1731—Peking, earthquake, 95,000 killed.
- 1746—Lima, earthquake, 18,000 killed.
- 1755—Lisbon, earthquake, 40,000 killed.
- 1772—Java, volcanic eruption, 3000 killed.
- 1773—Guatemala, earthquake, 33,000 killed.
- 1783—Calabria, earthquake, 40,000 killed.
- 1783—Iceland, volcanic eruption, 10,000 killed.
- 1797—Riobamba, Ecuador, earthquake, 41,000 killed.
- 1812—Caracas, earthquake, 10,000 killed.
- 1815—Island of Sumbawa, volcanic eruption, 12,000 killed.
- 1822—Aleppo, earthquake, 120,000 killed.
- 1822—Java, volcanic eruption, 4000 killed.
- 1853—Shiraz, Persia, earthquake, 12,000 killed.
- 1854—San Salvador, Guatemala, earthquake, 5000 killed.
- 1857—Kingdom of Naples, earthquake, 30,000 killed.
- 1859—Quito, earthquake, city destroyed, few lives lost.
- 1861—Mendoza, South America, earthquake, 10,000 killed.
- 1868—Ecuador and Peru, earthquake, 20,000 killed.
- 1883—Krakatoa, volcanic eruption, 36,000 killed.
- 1886—Charleston, earthquake, few lives lost.
- 1891—Island of Hondo, Japan, earthquake, 10,000 killed.
- 1894—Venezuela, earthquake, 3000 killed.
- 1902—Guatemala, earthquake, 2000 killed.
- 1902—St. Pierre, Martinique, volcanic eruption, 30,000 killed.
- 1902—Island of St. Vincent, volcanic eruption, 1600 killed.



THE HOME OF LUXURY

A Typical Home of the Wealthy in the West Indies. A Sketch by Our Artist.

PREFACE.

TACITUS relates how the palaces and noble residences of the beautiful ancient city of Pompeii were buried in ashes fathoms deep when Vesuvius awoke in its wrath ; and sacred history reveals the fate of the doomed Cities of the Plain when a rain of fire and brimstone poured down upon their spires and domes. No record of the past comes to us in more appalling form than these stories of sudden ruin and terrible slaughter by the elemental powers of the underworld. But once again, in our own days, these powers have awakened, and death and destruction have been showered down upon the tropical city of St. Pierre, the Pompeii of modern times. Dreadful as were the disasters of the past, this frightful calamity of the present surpasses them all in suddenness and fury. For days the ashes of Vesuvius rained down upon the famed Roman city before its destruction was complete, but minutes sufficed for the total overthrow of the fated West Indian city and the hurling into the valley of death of its thirty thousand doomed inhabitants. Here is a record of ruin never equalled in the history of volcanic fury, and one that should live in the memory of man as long as has that of the Roman city of summer palaces or of Sodom and Gomorrah, far remote in time.

Dreadful is the work that follows the clashing of sinking seas with the lakes of liquid fire pent up in the earth. Rack and ruin attend their meeting, and the dense solid shell of the earth is

rent asunder by their might. It is to the battle of fire and water in the depths of the rocks that the volcano and the earthquake are due, and when these demons of the depths are at war man's puny strength is as powerless as that of the leaf before the cyclone. Then terror comes ; then the earth trembles to its heart and is rent in twain ; then the ashes of a terrible burning are cast forth to bury fertile plains and flourishing cities ; then showers of burning rocks bombard the air and rivers of glowing lava scorch the earth, and human hopes and the results of man's labor are whelmed alike beneath the dread torrent of death and dismay.

In ruined St. Pierre a myriad of dead were left entombed in fiery lava and grey volcanic ash, while the few trembling fugitives wandered homeless and hopeless, with bereavement tugging at their heart-strings and famine dogging their errant footsteps. No human power could restore the vanished island landscapes nor bring back life to the charred cinders of what were once strong men and noble women. All that the benevolent world could do was to send quick relief to the starving fugitives and give fitting sepulture to the bodies of the dead, while offering up fervent prayers to the Almighty to stay the pent-up powers of the earth and save man from a renewal of such death-dealing calamities as that which befel the fair city of the tropic isles.

Mankind should not soon forget this dread disaster that has horrified the world. Nothing that has happened in modern times so amply deserves to be put upon record and thus kept for present and future generations to read. The man and woman who are not vitally interested in this story of terror can have no red blood in their veins, no human feeling in their hearts. That it may not be soon forgotten and its dread events rests as a shapeless horror in our thoughts, this story of its intensely stirring incidents has been

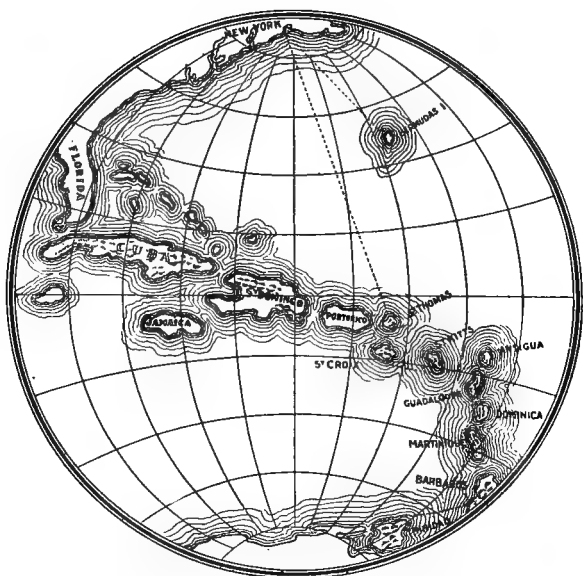
written. It is a story that should be read far and wide throughout the land and the memory of the terrible disaster thus fitly preserved. It is no work of the imagination of man that we present, no wild flight of fancy into the realms of the terrible and the appalling, but sober fact and actual history; but yet more thrilling in its details than anything that fiction could well invent. Bulwer, in his "Last Days of Pompeii," surrounds the fall of the Roman city with all the glamour of a story of the imagination, but for the record of the "Last Days of St. Pierre" sober truth will suffice; fiction could add no new interest to its dread details.

The fate of Martinique and St. Vincent cannot fail to awaken a desire to learn of the work of the volcano and the earthquake, those terrible sisters, in all times and all lands; the ruin caused by the far-famed Vesuvius and Etna; the frightful work of East Indian Krakatoa; the terrible slaughter done by the quaking earth in fifty far-removed regions; the horrors that have widely enveloped mankind when the demonic furies of the earth's deeps went forth "conquering and to conquer," treading the nations beneath their iron feet and leaving leagues of land a desolation and a curse.

The ruin of St. Pierre has served us as a text for many another tale of destructive fury in past and recent ages and far and near places. All the greatest convulsions of the earth are here recorded, all those terrible phenomena of nature which have made man almost fear to set his foot upon the earth, lest he might waken the demons sleeping far below. The whole story is one replete with pictures of the strength and force of the elemental powers, before which the power of man is like that of a fragment of driftwood borne on the ocean billows in their wrath.

We present here the record of the work of the dread sisters, from the tale of Pompeii down to that of St. Pierre. No one can read it

without a deep sense of awe and a feeling of the instability of man's works and the insecurity of human life. Truth is indeed stranger than fiction, and it is also more absorbing and thought-compelling when the truth is not that of the petty details of everyday life, but the vast events that come to us once in a generation. Such is the truth that is recorded in this book. Read it and be convinced.



MAP SHOWING RELATIVE LOCATIONS AND DISTANCES OF THE ISLANDS OF MARTINIQUE AND ST. VINCENT FROM THE AMERICAN CONTINENT.



TYPICAL STREET SCENE, ST. PIERRE, "OLD TOWN."



YELLOW CARIBS OF ST. VINCENT, LEEWARD ISLANDS, WEST INDIES

Engaged in a primitive mill of their own construction. These people were utterly destroyed by the eruption of La Soufriere volcano on the slopes of which they resided.

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CHAPTER I.

The Volcano and the Earthquake, Earth's Demons of Destruction.

TO most of us, dwellers upon the face of the earth, this terrestrial sphere is quite a comfortable place of residence. The forces of Nature everywhere and at all times surround us, forces capable, if loosened from their bonds, of bringing death and destruction to man and the work of his hands. But usually they are mild and beneficent in their action, not agents of destruction and lords of elemental misrule. The air, without whose presence we could not survive a minute, is usually a pleasant companion, now resting about us in soft calm, now passing by in mild breezes. The alternation of summer and winter is to us generally an agreeable relief from the monotony of a uniform climate. The variation from sunlight to cloud, from dry weather to rainfall, is equally viewed as a pleasant escape from the weariness of too great fixity of natural conditions. The change from day to night, from hours of activity to hours of slumber, are other agreeable variations in the events of our daily life. In short, a great pendulum seems to be swinging above us, held in Nature's kindly hand, and adapting its movements to our best good and highest enjoyment.

But has Nature,—if we are justified in personifying the laws and forces of the universe,—has mother Nature really our pleasure and benefit in mind, or does she merely suffer us to enjoy life like so many summer insects, until she is in the mood to sweep us like

leaves from her path? It must seem the latter to many of the inhabitants of the earth, especially to the dwellers in certain ill-conditioned regions. For all the beneficent powers above named may at a moment's notice change to destructive ones.

THE WIND IS A DEMON IN CHAINS

The wind, for instance, is a demon in chains. At times it breaks its fetters and rushes on in mad fury, rending and destroying, and sweeping such trifles as cities and those who dwell therein to common ruin. Sunshine and rain are subject to like wild caprices. The sun may pour down burning rays for weeks and months together, scorching the fertile fields, drying up the life-giving streams, bringing famine and misery to lands of plenty and comfort, almost making the blood to boil in our veins. Its antithesis, the rainstorm, is at times a still more terrible visitant. From the dense clouds pour frightful floods, rushing down the lofty hills, sweeping over fertile plains, overflowing broad river valleys, and, wherever they go, leaving terror and death in their path. We may say the same of the alternation of the seasons. Summer, while looked forward to with joyous anticipation, may bring us only suffering by its too ardent grasp; and winter, often welcomed with like pleasurable anticipations, may prove a period of terror from cold and destitution.

Such is the make-up of the world in which we live, such the vagaries of the forces which surround us. But those enumerated are not the whole. Can we say, with a stamp of the foot upon the solid earth, "Here at least I have something I can trust; let the winds blow and the rains descend, let the summer scorch and the winter chill, the good earth still stands firm beneath me, and of it at least I am sure?"

Who says so speaks hastily and heedlessly, for the earth can show itself as unstable as the air, and our solid footing become as insecure as the deck of a ship laboring in a storm at sea. The powers of the atmosphere, great as they are and mighty for destruction as they may become, are at times surpassed by those which abide within the earth, deep laid in the so-called everlasting rocks, slumbering often through generations, but at any time likely to awaken in wrath, to lift the earth into quaking billows like those of the sea, or pour forth torrents of liquid fire that flow in glowing and burning rivers over leagues of ruined land. Such is the earth with which we have to deal, such the ruthless powers of nature that spread around us and lurk beneath us, such the terrific forces which only bide their time to break forth and sweep too-confident man from the earth's smiling face.

THE SUBTERRANEAN POWERS

The subterranean powers here spoken of, those we had denominated earth's demons of destruction, are the volcano and the earthquake, the great moulding forces of the earth, tearing down to rebuild, rending to reconstitute, and in this elemental work often bringing ruin to man's boasted fanes and palaces.

No one who has ever seen a volcano or "burning mountain" casting forth steam, huge red-hot stones, smoke, cinders and lava, can possibly forget the grandeur of the spectacle. At night it is doubly terrible, when the darkness shows the red-hot lava rolling in glowing streams down the mountain's side. At times, indeed, the volcano is quiet, and only a little smoke curls from its top. Even this may cease, and the once burning summit may be covered over with trees and grass, like any other hill. But deep down in the earth the gases and pent-up steam, are ever preparing to force their

way upward through the mountain, and to carry with them dissolved rocks, and the stones which block their passage. Sometimes, while all is calm and beautiful on the mountains, suddenly deep-sounding noises are heard, the ground shakes, and a vast torrent tears its way through the bowels of the volcano, and is flung hundreds of feet high in the air, and, falling again to the earth, destroys every living thing for miles around.

It is the same with the earthquake as with the volcano. The surface of the earth is never quite still. Tremors are constantly passing onward which can be distinguished by delicate instruments, but only rarely are these of sufficient force to become noticeable, except by instrumental means. At intervals, however, the power beneath the surface raises the ground in long, billow-like motions, before which, when of violent character, no edifice or human habitation can for a moment stand. The earth is frequently rent asunder, great fissures and cavities being formed. The course of rivers is changed and the waters are swallowed up by fissures rent in the surface, while ruin impends in a thousand forms. The cities become death pits and the cultivated fields are buried beneath floods of liquid mud. Fortunately these convulsions, alike of the earthquake and volcano, are comparative rarities and are confined to limited regions of the earth's surface. What do we know of those deep-lying powers, those vast buried forces dwelling in uneasy isolation beneath our feet? With all our science we are but a step beyond the ancients, to whom these were the Titans, great rebel giants whom Jupiter overthrew and bound under the burning mountains, and whose throes of agony shook the earth in quaking convulsions. To us the volcanic crater is the mouth from which comes the fiery breath of demon powers which dwell far down in the earth's crust. The Titans themselves were dwarfs beside these

mighty agents of destruction whose domain extends for thousands of miles beneath the earth's surface and which in their convulsions shake whole continents at once. Such was the case in 1812, when the eruption of Mont Soufriere on St. Vincent, as told in a later chapter, formed merely the closing event in a series of earthquakes which had made themselves felt under thousands of miles of land.

ANCIENT AWE OF VOLCANOES

In olden times volcanoes were regarded with superstitious awe, and it would have been considered highly impious to make any investigation of their actions. We are told by Virgil that Mt. Etna marks the spot where the gods in their anger buried Enceladus, one of the rebellious giants. To our myth-making ancestors one of the volcanoes of the Mediterranean, set on a small island of the Lipari group, was the workshop of Vulcan, the god of fire, within whose depths he forged the thunderbolts of the gods. From below came sounds as of a mighty hammer on a vast anvil. Through the mountain vent came the black smoke and lurid glow from the fires of Vulcan's forge. This old myth is in many respects more consonant with the facts of nature than myths usually are. In agreement with the theory of its internal forces, the mountain in question was given the name of Volcano. To-day it is scarcely known at all, but its name clings to all the fire-breathing mountains of the earth.

As before said, at the present day we are little in advance of the ancients in actual knowledge of what is going on so far beneath our feet. We speak of forces where they spoke of fettered giants, but can only form theories where they formed myths. Is the earth's centre made up of liquid fire? Does its rock crust resemble the thick ice crust on the Arctic Seas, or is the earth, as later

scientists believe, solid to the core? Is it heated so fiercely, miles below our feet, that at every release of pressure the solid rock bursts into molten lava? Is the steam from the contact of underground rivers and deep-lying fires the origin of the terrible rending powers of the volcano's depths? Truly we can answer none of these questions with assurance, and can only guess and conjecture from the few facts open to us what lies concealed far beneath.

RARITY OF ANCIENT ACCOUNTS

In the history of earthquakes nothing is more remarkable than the extreme fewness of those recorded before the beginning of the Christian era, in comparison with those that have been registered since that time. It is to be borne in mind, however, that before the birth of Christ only a small portion of the globe was inhabited by those likely to make a record of natural events. The vast apparent increase in the number of earthquakes in recent times is owing to a greater knowledge of the earth's surface and to the spread of civilization over lands once inhabited by savages. The same is to be said of volcanic eruptions, which also have apparently increased greatly since the beginning of the Christian era. There may possibly have been a natural increase in these phenomena, but this is hardly probable, the change being more likely due to the increase in the number of observers.

The structure of a volcano is very different from that of other mountains, really consisting of layers of lava and volcanic ashes, alternating with each other and all sloping away from the center. These elevations, in fact, are formed in a different manner from ordinary mountains. The latter have been uplifted by the influence of pressure in the interior of the earth, but the volcano is an immediate result of the explosive force of which we have spoken, the mountain

being gradually built up by the lava and other materials which it has flung up from below. In this way mountains of immense height and remarkable regularity have been formed. Mount Orizabo, near the City of Mexico, for instance, is a remarkably regular cone, undoubtedly formed in this way, and the same may be said of Mount Mayon, on the Island of Luzon.

In many cases the irregularity of the volcano is due to subsequent action of its forces, which may blow the mountain itself to pieces. In the case of Krakatoa, in the East Indies, for instance, the whole mountain was rent into fragments, which were flung as dust miles high into the air. The main point we wish to indicate is that volcanoes are never formed by ordinary elevating forces and that they differ in this way from all other mountains. On the contrary, they have been piled up like rubbish heaps, resembling the small mountains of coal dust near the mouths of anthracite mines.

It is to the burning heat of the earth's crust and the influence of pressure, and more largely to the influx of water to the molten rocks which lie miles below the surface, that these convulsions of nature are due. Water, on reaching these overheated strata, explodes into volumes of steam, and if there is no free vent to the surface, it is apt to rend the very mountain asunder in its efforts to escape. Such is supposed to have been the case in the eruption of Krakatoa, and was probably the case also in the recent case of Mt. Pelee.

GENERAL DESCRIPTION OF ERUPTIONS

If we should seek to give a general description of volcanic eruptions, it would be in some such words as follows: An eruption is usually preceded by earthquakes which affect the whole surrounding country, and associated with which are underground explosions that seem like the sound of distant artillery. The mountain

quivers with internal convulsions, due to the efforts of its confined forces to find an opening. The drying up of wells and disappearance of springs are apt to take place, the water sinking downward through cracks newly made in the rocks. Finally the fierce unchained energy rends an opening through the crater and an eruption begins. It comes usually with a terrible burst that shakes the mountain to its foundation; explosions following rapidly and with increasing violence, while steam issues and mounts upward in a lofty column. The steam and escaping gases in their fierce outbreaks hurl up into the air great quantities of solid rock torn from the sides of the opening. The huge blocks, meeting each other in their rise and fall, are gradually broken and ground into minute fragments, forming dust or so-called ashes, often of extreme fineness, and in such quantities as frequently to blot out the light of the sun. There is another way in which a great deal of volcanic dust is made; the lava is full of steam, which in its expansion tears the molten rock into atoms, often converting it into the finest dust.

The eruption of Mt. Skaptar, in Iceland, in 1783, sent up such volumes of dust that the atmosphere was loaded with it for months, and it was carried to the northern part of Scotland, 600 miles away, in such quantities as to destroy the crops. During the eruption of Tomboro, in the East Indies, in 1815, so great was the quantity of dust thrown up that it caused darkness at midday in Java 300 miles away and covered the ground to a depth of several inches. Floating pumice formed a layer on the ocean surface two and a half feet in thickness, through which vessels had difficulty in forcing their way.

The steam which rises in large volumes into the air may become suddenly condensed with the chill of the upper atmosphere and fall as rain, torrents of which often follow an eruption. The rain, falling through the clouds of volcanic dust, brings it to the

earth as liquid mud, which pours in thick streams down the sides of the mountain. The torrents of flowing mud are sometimes on such a great scale that large towns, as in the instance of the great city of Herculaneum, may be completely buried beneath them. Over this city the mud accumulated to the depth of over 70 feet. In addition to these phenomena, molten lava often flows from the lip of the crater, occasionally in vast quantities. In the Icelandic eruption of 1783 the lava streams were so great in quantity as to fill river gorges 600 ft. deep and 200 ft. wide, and to extend over an open plain to a distance of 12 to 15 miles, forming lakes of lava 100 feet deep. The volcanoes of Hawaii often send forth streams of lava which cover an area of over 100 square miles to a great depth.

GREAT OUTFLOWS OF LAVA

In the course of ages lava outflows of this kind have built up in Hawaii a volcanic mountain estimated to contain enough material to cover the whole of the United States with a layer of rock 50 feet deep. These great outflows of lava are not confined to mountains, but take place now and then from openings in the ground, or from long cracks in the surface rocks. Occasionally great eruptions have taken place beneath the ocean's surface, throwing up material in sufficient quantity to form new islands.

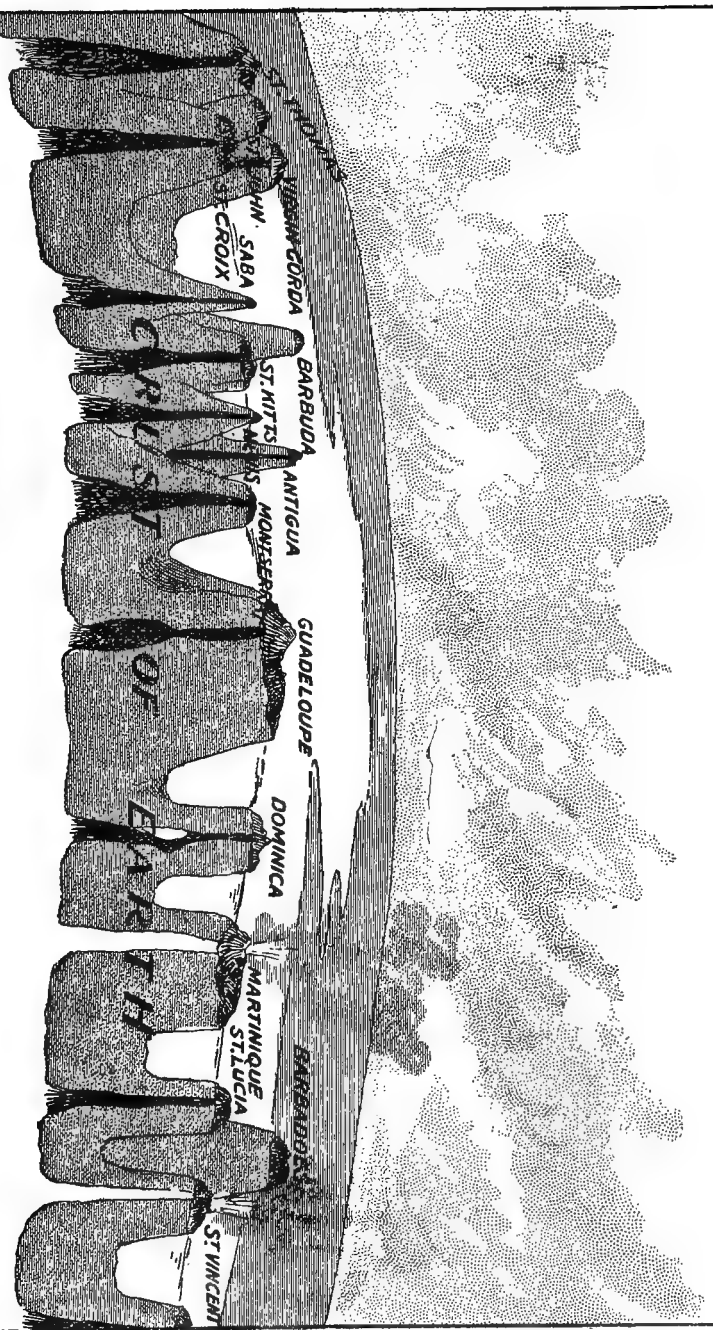
The formation of mud is not confined to the method given, but great quantities of this plastic material flow at times from volcanic craters. In the year 1691 Imbaburu, one of the peaks of the Andes, sent out floods of mud which contained dead fish in such abundance that their decay caused a fever in the vicinity. The volcanoes of Java have often buried large tracts of fertile country under volcanic mud.

An observation of volcanoes shows us that they have three well marked phases of action. The first of these is the state of permanent eruption, as in case of the volcano of Stromboli in the Mediterranean. This state is not a dangerous one, since the steam, escaping continually, acts as a safety valve. The second stage is one of milder activity with an occasional somewhat violent eruption; this is apt to be dangerous, though not often very greatly so. The safety valve is partly out of order. The third phase is one in which long periods of repose, sometimes lasting for centuries, are followed by eruptions of intense energy. These are often of extreme violence and cause widespread destruction. In this case the safety valve has failed to work and the boiler bursts.

OFTEN REST FOR LONG TERMS OF YEARS

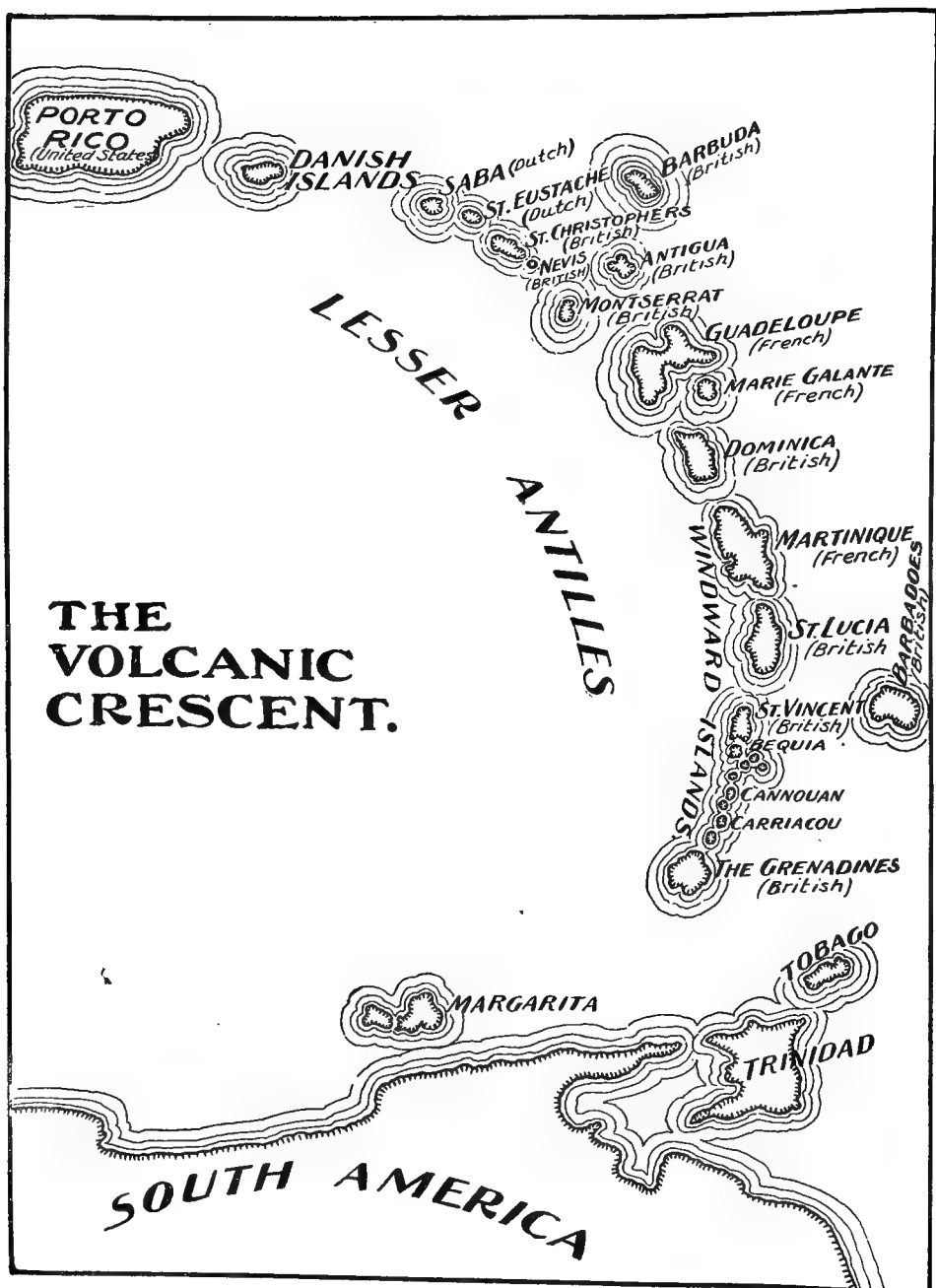
Such are the general features of action in the vast powers which dwell deep beneath the surface, harmless in most parts of the earth, frightfully perilous in others. Yet even here they often rest for long terms of years in seeming apathy, until men gather above their lurking places in multitudes, heedless or ignorant of the sleeping demons that bide their time below. Their time is sure to come, after years, perhaps after centuries. Suddenly the solid earth begins to tremble and quake; roars as of one of the buried giants of old strike all men with dread; then, with a fierce convulsion, a mountain is rent in twain and vast torrents of steam, burning rock, and blinding dust are hurled far upward into the air, to fall again and bury cities, perhaps, with all their inhabitants in indiscriminate ruin and death. A thrilling instance of this is that which came upon the beautiful West Indian Island of Martinique in May, 1902, the story of which it is our purpose to relate.

MOLTEN LAVA



SECTIONAL VIEW OF EARTH'S CRUST IN THE WEST INDIES

Showing how the Mountainous Islands Rise from Depths of the Sea and are Affected by the Water.



CHAPTER II.

The Volcanoes of the West Indian Regions.

THE volcanic outburst in the Caribbean Islands, which has so astonished the world, can hardly have been a matter of surprise for any geologist. In truth it should have been expected, although nobody could have predicted the time when it would occur, or the exact point that would be most affected, nor, indeed, the extent of the disaster. Our knowledge of the earth's crust is too incomplete for that.

Still the character of the chain of islands running southward from Guadeloupe and forming the eastern border of the Caribbean Sea was well enough understood to enable any geologist to affirm the existence of danger there. That line is notoriously one of the danger points of the earth. Within a distance of a very few hundred miles are ranged three or four volcanic vents whose appearance and history show that they are fully the rivals of Vesuvius in destructive power. Being situated on islands, and consequently surrounded on all sides by water, they have the proper environment to induce an outbreak whenever other circumstances are favorable to such an occurrence.

Moreover, the Caribbean Sea bottom is subject to earthquake disturbances, which are, perhaps, the direct result of the slow rising of the neighboring coast of South America. Wherever such an elevation is in progress a strain is necessarily brought to bear upon the rocks composing the underlying strata of the earth's

crust in the vicinity of the rising area, and every now and then a sudden slip, or break, is certain to occur, resulting in the formation of new fissures and the transmission of shocks which may act like the pulling of a trigger in releasing pent-up forces of vast magnitude.

Leeward and Windward are the names given by mariners to the islands comprising the Lesser Antilles, lying to the southeast of San Domingo and Porto Rico, including Guadeloupe, Dominica and Martinique to the north or Leeward, and Barbados, St. Lucia, Saint Vincent, Grenadine, Grenada and others to the south, called the Windward group. These islands are of volcanic origin, and many of them possess occasionally active volcanoes. They are looked upon as forming part of that great volcanic range which extends along the Pacific slope of America from Alaska to Chili.

THE FRENCH WEST INDIES

Of the islands named, Martinique and Guadeloupe belong to the French; the others are English possessions. Martinique, the central scene of the catastrophe that is threatening all of the islands of the Lesser Antilles, was a prosperous colony. It had, previous to the late disaster, a population of about 175,000, including about 10,000 white persons. The natives have been called by Lafcadio Hearn, the author, who spent two years among them, "the finest mixed race in the West Indies." The women are beautiful and the men tall, well formed and strong.

Of the 4,500 inhabitants of the island of St. Lucia not more than 2,000 are white. The majority of the white residents are French or of French origin. The natives are negroes and half-breeds of all shades of color, from full black to the nearly white octoroons. The original inhabitants were Caribs when Columbus

discovered the island in 1502. It was settled by the English in 1639. There were many struggles between the French and the English for its possession, first one power, then another, governing the island until 1803, when it passed finally under British authority.

Two cone-shaped rocks rise out of the sea to a height of 3,000 feet, and near these are the craters of the long extinct volcanoes that now have entered upon a dangerous activity. Near them are the sulphur pits so often seen in mountains of the West Indies, that often send forth steam, reminding the visitors that the subterranean fires have never been entirely extinguished.

ST. VINCENT AND ITS CAPITAL

At the northwest corner of the island of St. Vincent, one of the British West Indies, rises the volcano La Soufriere, that now threatens its destruction. It has often belched forth death to the inhabitants, but of late years has shown no signs of activity.

On the northeast corner, across the bay, and a few miles away from La Soufriere, is Kingstown, the capital of the island, with a population of about 6,000. The others of the 35,000 souls living on the island, which is only seventeen miles long, inhabit the mountains, and it is upon them that the present disaster will fall most heavily. Nearly all of the inhabitants are negroes or half-breeds. About 4,000 whites live on the island.

The population of Dominica is about 35,000. The capital is Roseau. The island is twenty-nine miles long and sixteen miles in width. Its surface is covered by volcanic rocks, and hot sulphur springs abound.

Grenada is one of the most beautiful of the West Indian islands. Its mountains of volcanic origin, rugged and higher than those of the other islands, traverse it from north to south. It has a population of about 65,000.

Guadeloupe is really two islands—that to the north, or Guadeloupe proper, being mountainous and wild. The southern island is low and marshy. The population of the island is about 135,000. It is one of the principal French colonies in the West Indies.

Trinidad, a partly volcanic island, which lies south of the Antilles, is famous for its lake of semi-liquid pitch or asphaltum—one of the most remarkable of natural productions.

THE THEORY OF TIDAL STRAIN

There are some scientists who ascribe the catastrophe to the tidal strain produced by the moon, which happened on the very day of the blowing up of Mont Pelee to be in conjunction with the sun and close to its perigee point, or point of nearest approach to the earth.

It is well known that in such circumstances the combined tidal power of the sun and moon has nearly its greatest value, this producing the highest tides, those known as spring tides. While the effect upon the crust of the earth must be relatively slight, yet it might be conceived to act in the manner of the pressure that causes a trigger to fall and thereby let loose the giant force stored up in a cannon.

It should be said, however, with regard to the theory that earthquakes and volcanic phenomena connected with them are more liable to occur when the moon is in conjunction or opposition to the sun than at other times, all efforts to find a satisfactory basis for the theory in the history of seismic phenomena have been heretofore unsuccessful. The evidence, in other words, is self-contradictory. Not long ago Mr. Egmetis, of the observatory at Athens, Greece, made public a report bearing on this question, and showing that it had been impossible to trace a connection between the positions of the moon and the hundreds of earthquake tremors felt

in Greece during the year 1900. But, on the other hand, the fact that the Martinique explosion occurred at new moon, and when the moon was nearly in perigee, may be taken, as far as it goes, as an instance in favor of the theory.

But whatever the remote causes of the outburst may have been, it is difficult to believe that the immediate cause can have been anything else than a gigantic explosion of steam in the bowels of the volcano. It is known that water penetrates to considerable depths in the earth, even in the middle of continents. Wherever crevices and caverns in the rocks exist water is to be found deep beneath the surface of the earth. Huge streams that may almost be described as rivers flow deep under some of the dry and barren lava fields and semi-deserts of the far West. Every farmer who drives a well to procure water for his stock where no surface streams exist has a practical acquaintance with the wonderful veining of the earth's crust with hidden water channels.

This water penetrates as deep as the gradually increasing heat of the planet will permit it to do while retaining the liquid form. If it encounters no excessively heated area of rocks capable of suddenly turning a great quantity of it into steam it causes no damages, and if slowly vaporized recondenses into water again before it reaches the surface.

THE EFFECT OF STEAM IN VOLCANIC ACTION

But when, as occurs at many points near the edges of the ocean basins—and, among other places, on the eastern side of the Caribbean Sea—the water that has leaked down from above, either from rivers or from the superincumbent seas, encounters deep cracks and fissures which allow it to penetrate to a region where the heat is sufficient to liquefy solid bodies, it is changed into superheated steam—a thing whose resistless power defies the

mightiest bonds ; and if the fissures are of considerable extent and the quantity of water is also great, even the rocky crust of the globe cannot withstand the explosive energy that is thus brought to bear upon it. This action and influence of subterranean waters will be found considered more at length in a later chapter.

But, it may be asked, why do not such explosions take place anywhere, at random, instead of through the crater of an existing volcano? The reply is that sometimes they do take place at random, if such an expression can properly be applied to a natural event, and when that happens we see the phenomenon of the formation of a new volcano. But ordinarily the explosion occurs through the vent, or throat, of an already existing volcano, because the weakest points, or lines, in the earth's crust are the places where new fissures are likely to be formed, and along these lines of weakness the volcanoes stand like rows of safety valves.

Such a fissure is believed to exist along the curving course of the Caribbean Islands, the fact being indicated by their general volcanic origin and the line of volcanoes which follow this remarkably regular crescent-like curve. Each island of this chain, beginning with Saba in the north and ending with Grenada in the south, is volcanic in character, and the chord of the arc they describe is about 360 miles in length.

THE REMAINS OF A LOST CONTINENT

Lying along the northern curve, oceanward, is a fragmentary chain of isles and islets which are coralline in structure—at least above the sea, though they may be erected upon volcanic bases far beneath. Each island is practically a single mountain thrown up from the ocean depths, the altitudes varying from 2,000 to 5,000 feet, and so evidently of volcanic origin that one may not err in

ascribing them to Vulcan's mighty hand. Mountain-tops, spires, pinnacles, thrust up through the sea, suggest the remains of a lost continent, or perhaps the beginnings of a newer one. A far-west Atlantis may yet appear, out of the debris of wrecked isles, a resurrected continent, lifting its head above the sea, and verifying the Platonian legend.

Should these islands be destroyed, and, in effect, disappear, one cannot conceive of their places being taken by any more beautiful ones. As every mountain shoots upward abruptly to an altitude that gives it practically the range of two climatic zones, temperate and tropical, every beautiful aspect of vegetation may be noted here. The sides of each partially submerged volcano, from base to peak, and even some of the crater-walls, are hung with richest tapestries in varying shades of green.

INDUBITABLE EVIDENCE OF VOLCANIC ACTION

The northernmost of the volcanic islands is Saba, a mountain rising above the ocean floor nobody knows how many thousand feet, but extending about 2,800 feet above water. It has been for many years a Dutch possession, and is the smallest property of Holland in the West Indies, perhaps in the world, having an area of about seven square miles only, and supporting not more than 1,800 inhabitants. The majority of the population is white, a rare thing in these islands. There are Dutch residents in other West Indian islands, but they are not the sturdy, clear-complexioned Dutch of Saba Island. The secret of their sturdiness and their healthfulness is found in the altitude at which they live; not one of them less than 800 or 900 feet above sea level.

The town of Bottom, 960 feet above the sea, where most of the people live, is so called because it lies at the bottom of an

extinct crater ; at least, it is supposed to be extinct, but this, as recent events have shown, is not too sure a thing to trust to in the West Indies.

Indubitable evidence of volcanic action is to be found in the vast deposits of crude sulphur, which is mined out of the cliffs hundreds of feet above the sea and sent down to vessels' holds by means of a wire tramway. As there is no harbor in Saba, so there is no roadway for vehicle or beast of burden, all the freight arriving there and all the produce shipped thence being carried on the backs of men and women.

Next neighbor to Saba is the Dutch island of Saint Eustatius, better known in that region as Statia. It has seen better days, but could not be more beautiful, at least so far as its mountain cone is concerned, which is about 1,500 feet in height and perfectly symmetrical. Its crater is covered with gigantic forest trees. Statia was once very wealthy, but is now poor and forgotten, though it is celebrated as the first place in which a foreign Power saluted the American flag. It has no harbor, only a roadstead.

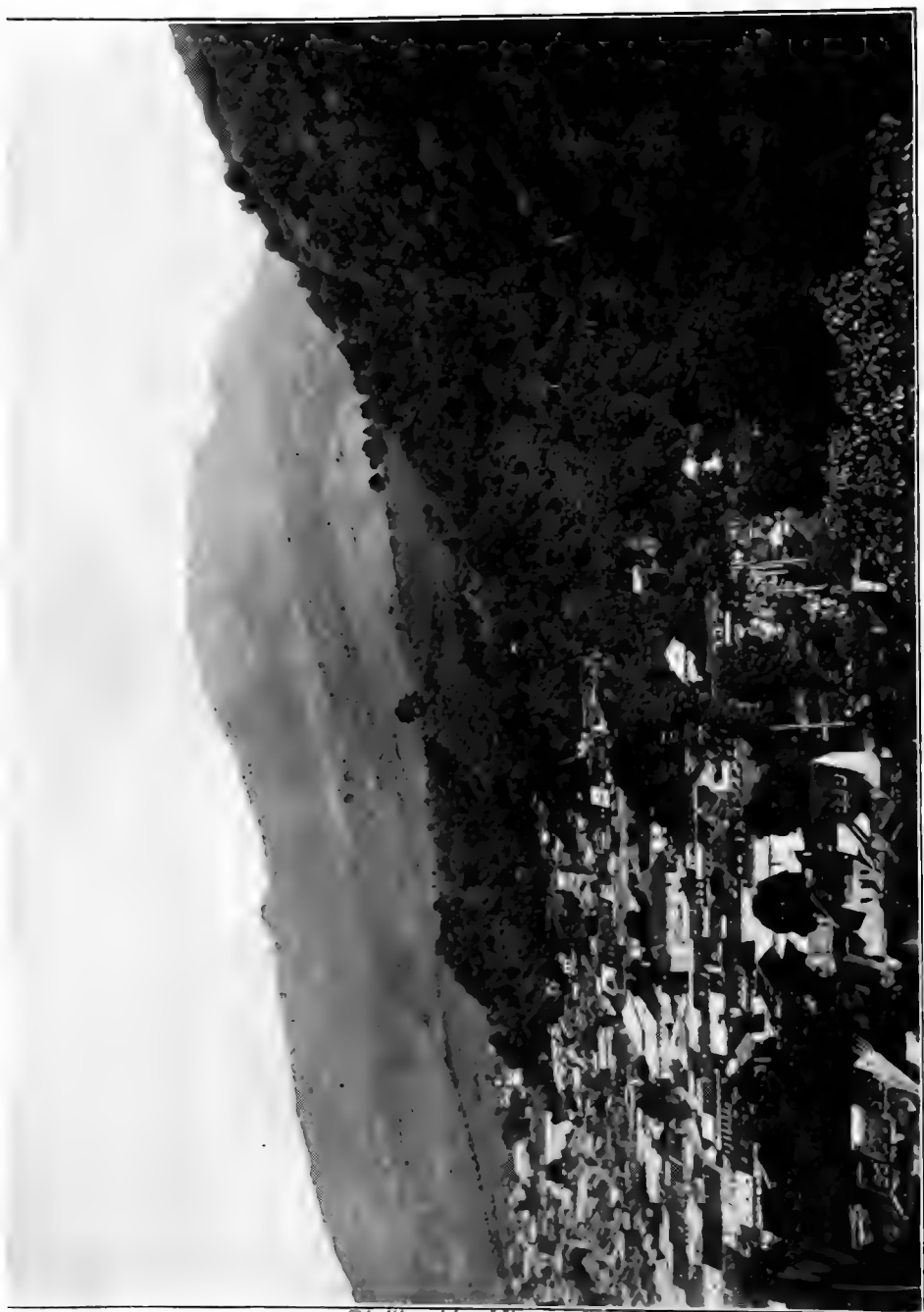
SEVERAL VOLCANIC ISLANDS

Of these islands none is more attractive from the sea than Saint Kitts, named by Columbus after his patron saint, Christopher. He discovered it, as indeed all these islands of the northern Caribbees, in the year 1493. This island was the original home of the buccaneers. Off its leeward coast a great naval battle was fought between English and French. Across a narrow channel rises the symmetrical peak of Nevis, which, like Mount Misery on St. Kitts, is forest-clad and with a fertile, verdant belt around it. Nevis was the birthplace of Alexander Hamilton, and here Lord Nelson was married. Next south of Nevis lies Montserrat, smaller yet, and between



Digitized by Microsoft®
CATHEDRAL, ST. PIERRE

This was one of the Prominent Edifices of the City.



ST. PIERRE, MARTINIQUE
Showing Mount Pelée in the Background, and the Residence Portion of the City in the Foreground.

the two islands the great rock of Redonda, a pinnacle shooting up out of the sea. Montserrat has a fine crater or "soufriere," and before it was devastated by a hurricane a few years ago was covered with groves of limes. Nevis has no well-defined crater, but has numerous hot and mineral springs.

The island next southerly, Guadeloupe, is the largest of the volcanic chain. It was discovered by Columbus on his second voyage, in 1493, and he, like all voyagers who have come after him, was enamored of its scenery, speaking enthusiastically of its magnificent forests and waterfalls. The town of Basse Terre on the coast line has an open roadstead, while Point-a-Pitre, the commercial port, has a fairly good harbor. In 1843 Guadeloupe had its disaster, not in the form of a volcanic eruption, but of an earthquake of destructive force, 5,000 lives being lost in Point-a-Pitre alone, while devastation extended widely over the island.

Dominica, about thirty miles south of Guadeloupe, is the most picturesque of the chain, containing grand and gloomy mountains, deep gorges, extensive forests, waterfalls, hot springs, a "boiling lake" in its crater, and many wonders of the faunal and botanical world. Dominica's only good harbor, that of Prince Ruperts, is unused on account of the insalubrity of the adjacent country, while Roseau, the commercial port, is an open roadstead. Mont Diablotin in Dominica is the highest peak of the chain, exceeding 5,000 feet.

Martinique, the next in the chain, calls for no description here, the following chapter being devoted to it. In Martinique and St. Lucia, but not in Dominica, next north of Martinique, is found that terribly venomous serpent, the "fer de lance," which is evil enough to have been the product of the particular Vulcan that forged the thunderbolts cast by Pelee at the devoted city of St. Pierre. More

than one of those who escaped from the flames may have met death from the poison fangs of this serpent as they sought succor after the eruption or groped their way blindly through the suffocating fumes and ashes to a place of safety.

THE ISLAND OF ST. LUCIA

Saint Lucia is but another Martinique on a smaller scale. It has a "Soufriere," or sulphur mine, larger than that in the crater of Mont Pelee, but situated at, or near, the southern end of the island, distant from the town of Castries, above which latter frown the fortifications erected by the British at an expense of many millions. Lying about midway between Martinique and Saint Vincent, it seems wonderful to the lay mind that Saint Lucia should thus far have escaped disaster. It is about one hundred miles as the crow flies, from Mont Pelee, at the north end of Martinique, to the Soufriere, at the north end of Saint Vincent, the eruption from which was almost synchronous with that from the former. There is no town nearer the volcano than a little settlement called Chateau Belaire, on the leeward coast, which lies about opposite the port of Georgetown at the windward—as the east coast is called. From one town to the other, all the way round the north end of the island, the plantations and provision grounds have been absolutely wiped out. Not many of the lives lost were those of white people in either island, the majority being colored.

Space remains only for a mere allusion to the southernmost island of the Caribbean chain, little Grenada, which, with a crater in its central hills, and its chief harbor in a crater, is in a good situation for some interesting developments, if volcanic activity should in the future spread from the two islands midway the chain to its two extremes,

CHAPTER III.

The Island of Martinique and the City of St. Pierre.

SAINTE PIERRE is the principal city of the French island of Martinique, having a population of over 25,000, and is one of the most important cities in the Lesser Antilles. Situated on the west coast of the island of Martinique, the town faces an open roadstead sheltered by high mountains from the easterly trade winds, and affording anchorage for hundreds of vessels. The town proper is built on the slope of a high range of hills separated by a valley and a small stream, which have been made into a park, with stately avenues extending up the valley to the rear of the town, where it joins what is conceded to be the handsomest botanical garden in the West Indies.

Originally it was built entirely of stone. After several earthquakes, which resulted in terrible loss of life, the inhabitants built their houses of wood. Then the town was fire swept and stone was again used as the general building material. After several earthquakes wood once more was used, but the place was destroyed by fire again about eight years ago.

The streets of the town, while narrow, are paved, with broad gutters in the centre, down which flows a steady stream of water from springs in the hills, keeping the streets in a condition of nearly absolute cleanliness. Adjoining the city on the north are several large sugar factories, including the Guerin Works, one of

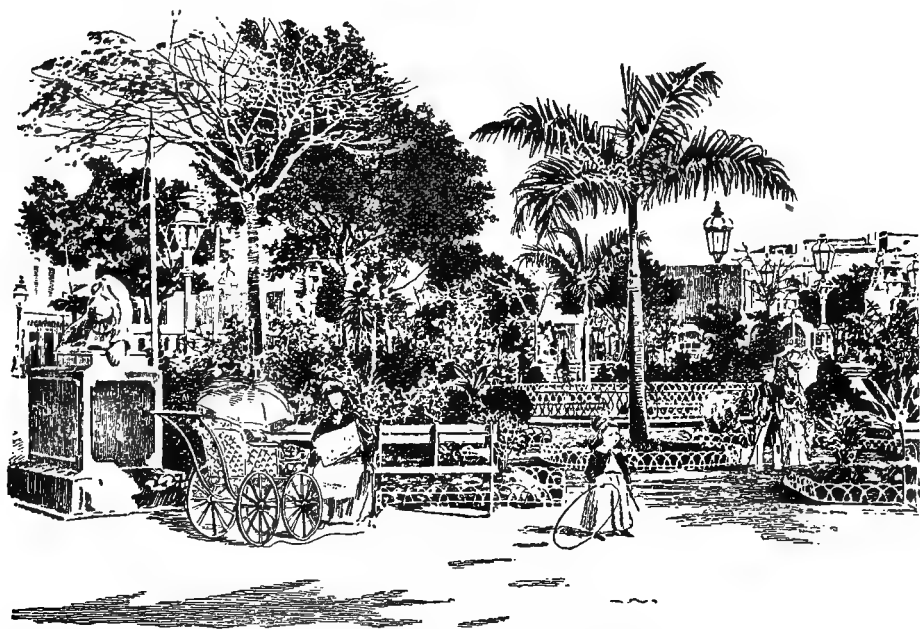
the largest in the West Indies. A tramway connects the southern portion of the city with the northern, a peculiar feature of the line being the women conductors. The motive power is mules. In addition to the many factories producing sugar, rum and Florida water, Saint Pierre is the distributing point of the French West Indies and for French Guiana. Two handsome cathedrals, the new and the old, several attractive public buildings, and a municipal opera house, which maintains a permanent opera company, are among the noteworthy features of the city.

THE NATIVES OF MARTINIQUE

The natives are for the most part negroes. The other natives are of French extraction, and the language of the latter nation is universally spoken. The picturesque situation of the city, with the gay costumes of the natives, gives the place a decidedly operatic appearance. The climate is almost perfect.

The population of St. Pierre is like the people of the Arabian Nights. European, negro and Indian combined to make this strange race, but the Indian seemed to predominate. It is many colored, but the general, dominant tint is yellow, like that of the town of St. Pierre itself. It is a race of half-breeds, the finest mixed race in the West Indies. Lafcadio Hearn says of these people: "Straight as palms and supple and tall, these colored women and men impress one wonderfully by their dignified carriage and easy elegance of movement. They walk without swinging of the shoulders—the perfectly set torso seems to remain rigid; yet the step is a long, full stride, and the whole weight is springingly poised on the very tip of the bare foot. All, or nearly all, are without shoes; the treading of many feet over the heated pavement makes a continuous, whispering sound.

“Perhaps the most novel impression of all is that produced by the singularity and brilliancy of certain of the women’s costumes, especially their head-dress. It is merely an immense Madras handkerchief, which is folded about the head with admirable art, like a turban—one bright end pushed through at the top in front being left sticking up like a plume. Then this turban, always full of bright canary color, is fastened with golden brooches—one in front and one



A BEAUTIFUL PARK IN ST. PIERRE

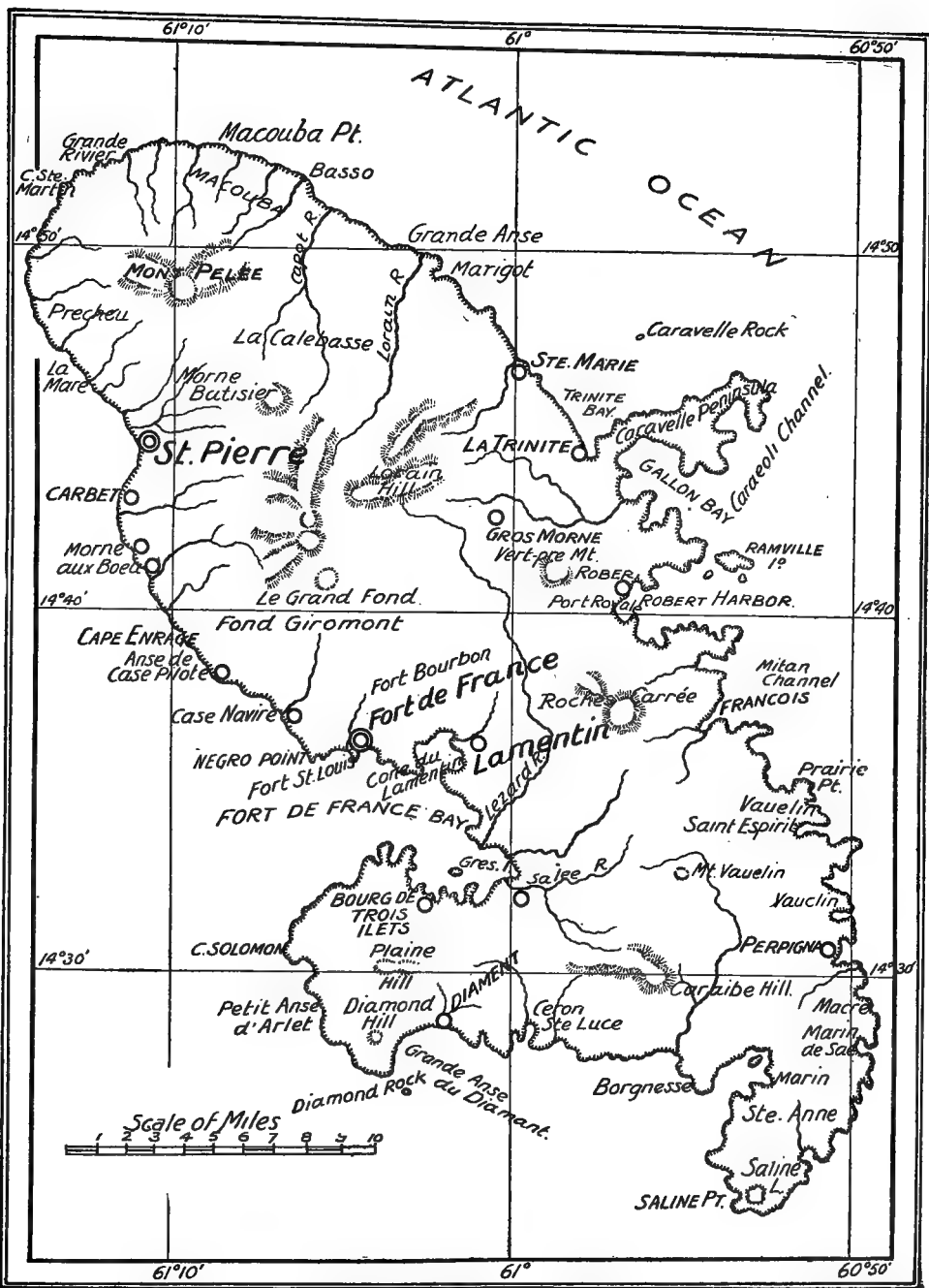
at either side. As for the remainder of the dress, it is simple enough ; an embroidered, lowcut chemise with sleeves ; a skirt or jupe, very long behind, but caught up and fastened in front below the breast so as to bring the hem everywhere to a level with the end of the long chemise, and finally a foulard or silken kerchief thrown over the shoulders. These jupes and foulards, however, are exquisite in

pattern and color ; bright crimson, bright yellow, bright blue, bright green—lilac, violet, rose—sometimes mingled in plaidings or checkings or stripings, black with orange, sky-blue with purple.

“ But few are thus attired. The greater number of the women carrying burdens on their heads—peddling vegetables, cakes, fruit, ready-cooked food from door to door—are very simply dressed in a single plain robe of vivid colors reaching from neck to feet, and made with a train, but generally girded well up so as to sit close to the figure and leave the lower limbs partly bare and perfectly free. These women can walk all day long up and down hill in the hot sun, without shoes, carrying loads of from one hundred to one hundred and fifty pounds on their heads, and if their little stock sometimes fails to come up to the accustomed weight stones are added to make it heavy enough. And the creole street cries, uttered in a sonorous, far-reaching high key, interblend and produce random harmonies very pleasing to hear.”

The people of Martinique are very poor, although outwardly their houses and shops give an impression of wealth. The buildings are very pretty, are in colors red, white and blue, and are kept up very well. Inside the shops the displays appear to be quite lavish, but there are few moneyed purchasers. The credit system prevails almost exclusively. The majority of the people—who are black, of course—live on next to nothing. Four pence (eight cents) a day is the usual wage for labor, and is about as much as the employers can afford to pay. The laborers work very hard for the small wage. As in most of the West Indian Islands, the women greatly outnumber the men, and do the brunt of the manual labor.

We have spoken, as the reader will perceive, in the present tense, as though St. Pierre were a thing of the present, and its inhabitants living and breathing men and women. But in truth these



MAP OF THE ISLAND OF MARTINIQUE, SHOWING ST. PIERRE, MT. PELEE, AND OTHER
POINTS OF INTEREST

people, with few exceptions, have ceased to live, and their former place of habitation is a city of the past, a Pompeii of the West Indies.

LIFE AND MANNERS IN ST. PIERRE.

Merchants and ship captains who know the Windward Islands cannot conceive of the gay little port of St. Pierre de Martinique being covered with ashes and lava. As do all the colonial capitals of the French, St. Pierre followed as closely as the steamers and mails would permit the customs and fashions of Paris. At the Hotel des Bains, at the "absinthe hour," one might always find a gathering of young men of the town, who sat sipping their liqueurs and chatting gaily.

The Rue de Victor Hugo was the principal thoroughfare. All of the best shops were located on it, and it served as a parade for the fashionables when they made their appearance in the cool of the evening, arrayed in their white ducks, Panama hats, and low-cut patent leather shoes, and the women either in the year-old fashions of Paris or in the striking, gaily colored native garb.

The Cathedral, the Opera House (where traveling companies played before enthusiastic audiences), the Hotel des Bains and the banks were probably the largest and best built buildings in the town. French was the common language, and nearly all of the white people were of French extraction. It was a lively little place, and its people had some of the light spirit and gaiety of their Gallic kinsmen. Always on coming into the harbor passengers noted the apparent freshness and cleanliness of the place. The white houses, with their green blinds and tiled or thatched roofs, the gay striped awnings and vivid green of the background, made a cool, pleasant picture. Ashore, the bright costumes of the native girls, the movement of the street life and the strangeness of the new scenes were a source of constant interest to tourists.





The upper or new town was the most attractive part of the place. The streets were broader and cleaner, and the buildings of a better quality. All of the streets were narrow, even the Rue de Victor Hugo being scarcely wide enough to permit two carriages to pass abreast.

Through every street, as above said, ran an open gutter of water, and early in the morning, just when the cool dawn wind was coming down from the mountains, these gutters would be alive with people. The native women would bring out their tall earthen jars, called "Welsh hats" by the resident Englishmen, to be filled with the cool, flowing water. Babies were brought out and allowed to disport themselves, while their mothers cleansed the household utensils. The streams being fed from mountain lakes, cleanliness in dress and habitation was common, even among the lowest classes.

Back from St. Pierre about eight miles, on a winding mountain road, was the fashionable native resort, Morne Rouge. Here the rich residents had their country homes. In the season, which began about June 1, there were usually 4,000 or 5,000 persons at Morne Rouge. Probably half that number had gone out this year to open their villas.

SITUATION OF THE CITY

There were no wharves or quays at St. Pierre, and really no harbor—simply an open roadstead with deep water inshore. The island rises sheerly from the sea, and there was no anchorage until the ships got within 300 feet of the buildings on shore. Skip-pers of sailing vessels would take their ships close in and anchor with bows pointed seaward and with a stern line out to steady the craft. They had to be alert during the rainy or stormy season, because of their exposed condition, and be ready to slip anchors and run out to sea.

Where St. Pierre was, the coast line curves inland like a slightly bent bow. Describing it, one of the shopkeepers on the Rue de Victor Hugo used to say that the town was situated on a bay shaped "like a dilemma, with a volcano on one horn and a tropical jungle on the other." He had got the phrase from an English correspondent, who had wondered what the inhabitants would do if such a calamity as the present one ever occurred. The Englishman had noted the lack of roads leading from the town and the futility of any hope of escape.

The town was built on the flat, narrow foreshore that lay between the foot of the steep wooded mountains and the sea. The houses and shops were built down to the water's edge and clustered in irregular groups about the Cathedral, which was situated directly opposite where the ships lay in the roadstead, and was the prominent architectural feature of the town. It was built of a whitish stone, and with its two towers, in which bells were hung, was sharply accentuated against the green background of the mountains. The water front of the town extended for nearly two miles along the gently curving coast. All the space back to the hills that shut in the town was filled with the low white houses of the people. Some twenty or twenty-five streets ran down from the hills to the water front. These were cut by irregular cross-streets.

There were a great many Americans in business in St. Pierre. The business of the island seemed to be about equally divided between French and American merchants. There were very few Englishmen on the island. The whites were practically all Americans and French. During the Winter there have been thousands of American tourists on the island. It was a delightful place to spend a few weeks; the climate always was superb, and everything about the place was sure to charm the visitor.

Martinique, the island of which St. Pierre was the commercial city, is the longest and most northerly of the Windward Islands, which form a portion of the chain of the Lesser Antilles. It is placed about the middle of the series which stretches in a curved line from Porto Rico almost to the coast of Venezuela. It is situated almost midway between Dominica and St. Lucia, twenty miles north of the latter place, and is about forty-five miles long and from ten to fifteen miles wide. Extensive masses of volcanic rocks cover the interior of the island, in which there are six extinct volcanoes, in addition to the active Mont Pelee, which has just shown itself the reverse of extinct. Only about two-fifths of the island is under cultivation, but the land is of extraordinary fertility, producing great quantities of sugar, coffee and cocoa.

HISTORY OF THE ISLAND

The island, which was discovered by the Spaniards in 1493, was settled by the French in 1635, captured by the British in 1794 and again in 1809, but restored to France for the second time in 1814. The population is 160,000, mostly colored.

Due in part to the bounty system of the French Government, Martinique and Guadeloupe are prosperous and contented, in strong contrast to the now poor and needy British islands adjoining. This condition is so apparent that even the casual visitor cannot fail to notice the difference. The native population is also more sprightly and more gaudily dressed than the negroes of the adjoining islands of St. Lucia, Dominica and particularly Antigua, yet the sugar trade, which is practically the only commercial industry of the Island of Martinique, has not been profitable of late years, and the future of both Martinique and Guadeloupe, even before the eruption of Mont Pelee, was very gloomy. The French Government, it is

said, intends to remove the bounty from sugar, and without this bounty the industry cannot live, and without the industry the people of the island cannot very well subsist.

Martinique is probably best known as having been the birth-place of the unfortunate Empress Josephine, in whose honor a handsome statue has been erected at Fort de France, a seaport on the east coast, the centre of an important coal trade, numerous and regular shipments of coal being made from this port.

Fort de France was originally known as Port Royal, this being changed on the advent of Republican rule. Two rivers border it, while the hills recede farther from the shore than at St. Pierre. Trees are scarce save in the park, where are long and thickly planted rows of tamarinds and mangoes, a double line of them enclosing a large open space, covered with luxuriant grass. In the centre of this space stands the statue of which we have spoken, the queenly Josephine, a figure of majestic poise and graceful outline, its material the purest white marble. Surrounding it is a circle of magnificent palms, whose glorious crowns rival that which adorns the head of the Empress, whose left hand rests on a medallion of Napoleon. On the pedestal a bas relief in bronze represents Napoleon before Josephine and in the act of placing a crown upon her head.

Near the southern end of Martinique the island is nearly divided in two by a deep bay. On the northern side of this stands Fort de France, and directly south of it lies the little town of Trois-Ilets, hidden from view by a deep cape. In the vicinity of this small place is the plantation of La Pagerie, the birthplace of the child who was to become the Empress of France. It is a place which all tourists to the island visit. In its present state the dwelling is not of attractive aspect, it being a low wooden-house, with

a roof of tiles, the whole old and dilapidated, while over the door is the common shop sign *Debit de la Ferme*, showing that rum and salt-fish are here on sale. This, however, the visitor soon learns, is not the house in which was born the future Empress, but its successor, the original house having been destroyed by a hurricane shortly after her birth. But the materials of which it is constructed came from the birth-place of Josephine. Of the buildings of her period there remain only the old kitchen and the sugar house of the estate.

Another native of Martinique to whom some degree of notability attaches, was Alexandre de Beauharnais, the first husband of the future bride of Napoleon and Empress of France. He was one of the victims of the Revolution, but his son, Eugene de Beauharnais, rose high in the favor of Napoleon, was made a prince and viceroy of Italy, and in 1812 commanded a corps of the grand army.

CHAPTER IV.

Mont Pelee and its Harvest of Death.

THE city of St. Pierre, Martinique, lies along the coast of its bay, for a length of about a mile, with high cliffs hemming it in, the houses of stone and brick, covered with brown earthen tiles, climb up to the hills, tier upon tier. At one place, where a river breaks through the cliffs, the city creeps further up towards the mountains. As seen from the bay, its appearance is picturesque and charming, with the soft tints of its tiles, the grey of its walls, the clumps of verdure in its midst, and the wall of green in the rear. Seen from its streets this beauty disappears, and the chief attraction of the town is gone.

Back from the three miles of hills which sweep in an arc round the town, is the noble *Montagne Pelée* lying several miles to the north of the city, a mass of dark rock some four thousand feet high, with jagged outline, and cleft with gorges and ravines, down which flow numerous streams, gushing from the crater lake of the great volcano.

Though known to be a volcano, it was looked upon as practically extinct, though as late as August, 1856, it had been in eruption. No lava at that time came from its crater, but it hurled out great quantities of ashes and mud, with strong sulphurous odor. Then it went to rest again, and slept till 1902.

The people had long ceased to fear it. No one expected that grand old Mont Pelee, the slumbering (so it was thought),

tranquil old hill, would ever spurt forth fire and death. This was entirely unlooked for. Mont Pelee was regarded by the natives as a sort of protector; they had an almost superstitious affection for it. From the outskirts of the city it rose gradually, its sides grown thick with rich grass, and dotted here and there with spreading shrubbery and drooping trees. There was no pleasanter outing for an afternoon than a journey up the green, velvet-like sides of the towering mountain and a view of the quaint, picturesque city slumbering at its base.

A PEACEFUL SCENE

There were no rocky cliffs, no crags, no protruding boulders. The mountain was peace itself. It seemed to promise perpetual protection. The poetic natives relied upon it to keep back storms from the land and frighten, with its stern brow, the tempests from the sea. They pointed to it with profoundest pride as one of the most beautiful mountains in the world.

Children played in its bowers and arbors; families picnicked there day after day during the balmy weather; hundreds of tourists ascended to the summit and looked with pleasure at the beautiful crystal lake which sparkled and glinted in the sunshine. Mont Pelee was the place of enjoyment of the people of St. Pierre. I can hear the placid natives say: "Old Father Pelee is our protector—not our destroyer."

Not until two weeks before the eruption; did the slumbering mountain show signs of waking to death and disaster. On the 23d of April it first displayed symptoms of internal disquiet. A great column of smoke began to rise from it, and was accompanied from time to time by showers of ashes and cinders.

Despite these signals, there was nothing until Monday, May 5th, to indicate actual danger. On that day a stream of smoking

mud and lava burst through the top of the crater and plunged into the valley of the River Blanche, overwhelming the Guerin sugar works and killing twenty-three workmen and the son of the proprietor. Mr. Guerin's was one of the largest sugar works on the island ; its destruction entailed a heavy loss. The mud which overwhelmed it followed the beds of streams towards the north of the island.

The alarm in the city was great, but it was somewhat allayed by the report of an expert commission appointed by the Governor, which decided that the eruption was normal and that the city was in no peril. To further allay the excitement, the Governor, with several scientists, took up his residence in St. Pierre. He could not restrain the people by force, but the moral effect of his presence and the decision of the scientists had a similar disastrous result.

A GRAPHIC DESCRIPTION BY A SUFFERER.

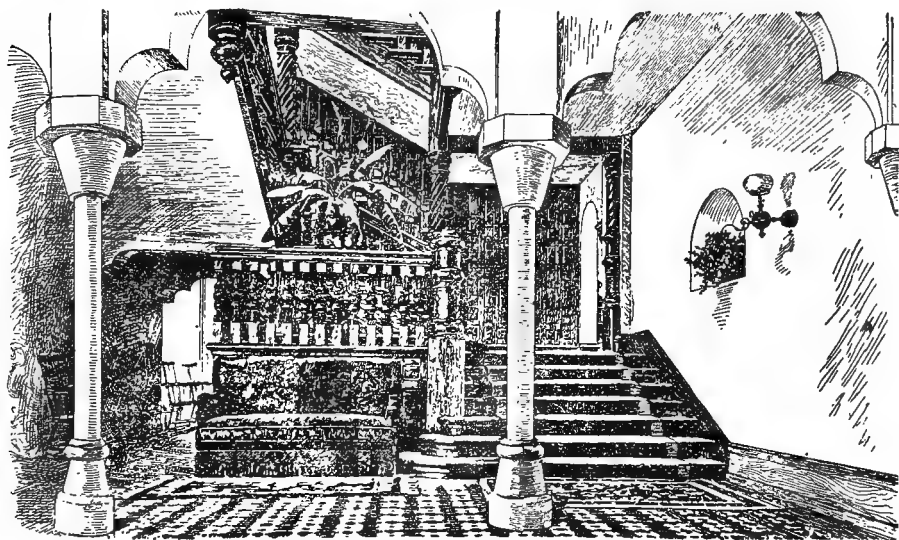
The existing state of affairs during these few waiting days is so graphically given in a letter from Mrs. Thomas T. Prentis, wife of the United States Consul at St. Pierre, to her sister in Melrose, a suburban city of Boston, that we quote it here :

"My Dear Sister: This morning the whole population of the city is on the alert and every eye is directed toward Mont Pelee, an extinct volcano. Everybody is afraid that the volcano has taken into its heart to burst forth and destroy the whole island.

"Fifty years ago Mont Pelee burst forth with terrific force and destroyed everything within a radius of several miles. For several days the mountain has been bursting forth in flame and immense quantities of lava are flowing down its sides.

"All the inhabitants are going up to see it. There is not a horse to be had on the island, those belonging to the natives being kept in readiness to leave at a moment's notice.

"Last Wednesday, which was April 23rd, I was in my room with little Christine, and we heard three distinct shocks. They were so great that we supposed at first that there was some one at the door, and Christine went and found no one there. The first report was very loud, and the second and third were so great that dishes were thrown from the shelves and the house was rocked.



INTERIOR OF A HOME IN ST. PIERRE

"We can see Mont Pelee from the rear windows of our house, and although it is fully four miles away, we can hear the roar of the fire and lava issuing from it.

"The city is covered with ashes and clouds of smoke have been over our heads for the last five days. The smell of sulphur is so strong that horses on the streets stop and snort, and some of them are obliged to give up, drop in their harness and die from suffocation. Many of the people are obliged to wear wet handkerchiefs over their faces to protect them from the fumes of sulphur.

"My husband assures me that there is no immediate danger, and when there is the least particle of danger we will leave the place. There is an American schooner, the *R. J. Morse*, in the harbor, and she will remain here for at least two weeks. If the volcano becomes very bad we shall embark at once and go out to sea. The papers in this city are asking if we are going to experience another earthquake similar to that which struck here some fifty years ago."

THE FATEFUL EIGHTH OF MAY

The writer of this letter and her husband, Consul Prentis, trusted Mont Pelee too long. They perished, with all the inhabitants of the city, in a deadly flood of fire and ashes that descended on the devoted place on the fateful morning of Thursday, May 8th. Only for the few who were rescued from the ships in the harbor there would be scarcely a living soul to tell that dread story of ruin and death. The most graphic accounts are those given by rescued officers of the *Roraima*, one of the fleet of the Quebec Steamship Co., trading with the West Indies. This vessel had left the Island of Dominica for Martinique at midnight of Wednesday, and reached St. Pierre about 7 o'clock Thursday morning. The greatest difficulty was experienced in getting into port, the air being thick with falling ashes and the darkness intense. The ship had to grope its way to the anchorage. Appalling sounds were issuing from the mountain behind the town, which was shrouded in darkness. The ashes were falling thickly on the steamer's deck, where the passengers and others were gazing at the town, some being engaged in photographing the scene.

The best way in which we can describe a scene of which few lived to tell the story, is to give the narratives of a number of the survivors. From their several stories a coherent idea of the terrible

scene can be formed. From the various accounts given of the terrible explosion by officers of the *Roraima*, we select as a first example the following description by Assistant Purser Thompson :

A TALE OF SUDDEN RUIN

"I saw St. Pierre destroyed. It was blotted out by one great flash of fire. Nearly 40,000 persons were all killed at once. Out of eighteen vessels lying in the roads only one, the British steamship *Roddam*, escaped, and she, I hear, lost more than half on board. It was a dying crew that took her out.

"Our boat, the *Roraima*, of the Quebec Line, arrived at St. Pierre early Thursday morning. For hours before we entered the roadstead we could see flames and smoke rising from Mont Pelee. No one on board had any idea of danger. Captain G. T. Muggah was on the bridge, and all hands got on deck to see the show.

"The spectacle was magnificent. As we approached St. Pierre we could distinguish the rolling and leaping of the red flames that belched from the mountain in huge volumes and gushed high into the sky. Enormous clouds of black smoke hung over the volcano.

"When we anchored at St. Pierre I noticed the cable steamship *Grappler*, the *Roddam*, three or four American schooners and a number of Italian and Norwegian barks. The flames were then spurting straight up in the air; now and then waving to one side or the other for a moment and again leaping suddenly higher up.

"There was a constant muffled roar. It was like the biggest oil refinery in the world burning up on the mountain top. There was a tremendous explosion about 7.45 o'clock, soon after we got in. The mountain was blown to pieces. There was no warning. The side of the volcano was ripped out, and there was hurled

straight toward us a solid wall of flame. It sounded like thousands of cannon.

"The wave of fire was on us and over us like a lightning flash. It was like a hurricane of fire. I saw it strike the cable steamship *Grappler* broadside on and capsize her. From end to end she burst into flames and then sank. The fire rolled in mass straight down upon St. Pierre and the shipping. The town vanished before our eyes and the air grew stifling hot, and we were in the thick of it.

"Wherever the mass of fire struck the sea the water boiled and sent up vast clouds of steam. The sea was torn into huge whirlpools that careened toward the open sea.

"One of these horrible hot whirlpools swung under the *Roraima* and pulled her down on her beam ends with the suction. She careened way over to port, and then the fire hurricane from the volcano smashed her, and over she went on the opposite side. The fire wave swept off the masts and smokestack as if they were cut with a knife.

HEAT CAUSED EXPLOSIONS

"Captain Muggah was the only one on deck not killed outright. He was caught by the fire wave and terribly burned. He yelled to get up the anchor, but, before two fathoms were heaved in the *Roraima* was almost upset by the boiling whirlpool, and the fire wave had thrown her down on her beam ends to starboard. Captain Muggah was overcome by the flames. He fell unconscious from the bridge and toppled overboard.

"The blast of fire from the volcano lasted only a few minutes. It shriveled and set fire to everything it touched. Thousands of casks of rum were stored in St. Pierre, and these were exploded by the terrific heat. The burning rum ran in streams down every street

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MOUNT PELEE AND THE DESTRUCTION OF THE VESSELS IN THE HARBOR OF ST. PIERRE





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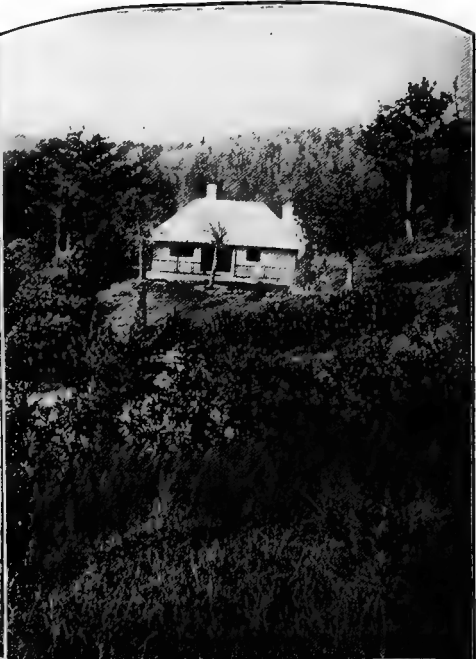
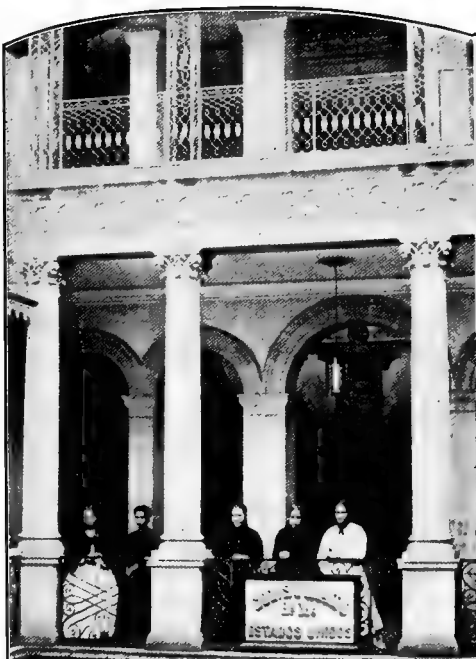
FIGHTING FOR FOOD AT FORT DE FRANCE
Before the Relief Expedition Arrived.



A TYPICAL STREET SCENE IN ST. PIERRE, MARTINIQUE

Copyright, J. Murray Jordan.

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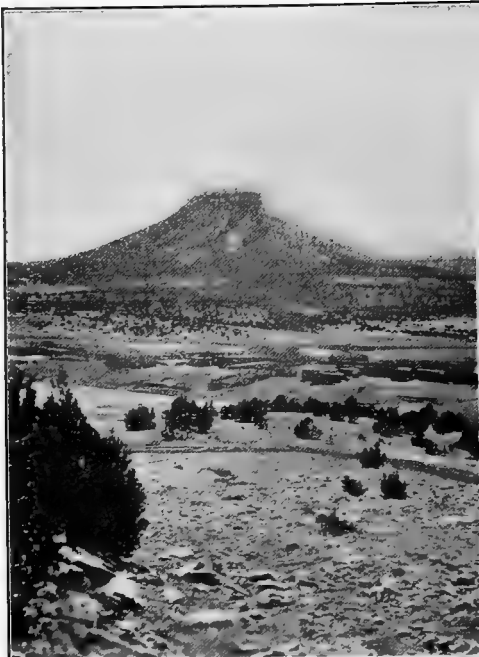
GROUP OF CHARACTERISTIC PICTURES

1. An Interior View of a Modern House.
2. A Farmer's Plantation.
3. The Home of a Government Official

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FOUR TYPICAL LADIES OF THE WINDWARD ISLANDS



A GROUP OF CHARACTERISTIC PICTURES

- (1.) An Ancient Volcanic Peak, (2) A Street Corner in Trinidad, (3) A View of Hamilton, Bermuda, (4) A Relief Ship.

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JAPANESE REGIONS DEVASTATED BY A GREAT EARTHQUAKE



A ROUGH MOUNTAIN STREAM IN MARTINIQUE
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and out to the sea. This blazing rum set fire to the *Roraima* several times. Before the volcano burst the landings of St. Pierre were crowded with people. After the explosion not one living being was seen on land. Only twenty-five of those on the *Roraima* out of sixty-eight were left after the first flash.

"The French cruiser *Suchet* came in and took us off at 2 P. M. She remained nearby, helping all she could, until 5 o'clock, then went to Fort de France with all the people she had rescued. At that time it looked as if the entire north end of the island was on fire."

C. C. Evans, of Montreal, and John G. Morris, of New York, who were among those rescued, say the vessel arrived at 6 o'clock. As eight bells were struck a frightful explosion was heard up the mountain. A cloud of fire, toppling and roaring, swept with lightning speed down the mountain side and over the town and bay. The *Roraima* was nearly sunk, and caught fire at once.

"I can never forget the horrid, fiery, choking whirlwind which enveloped me," said Mr. Evans. "Mr. Morris and I rushed below. We are not very badly burned, not so bad as most of them. When the fire came we were going to our posts (we are engineers) to weigh anchor and get out. When we came up we found the ship afire aft, and fought it forward until 3 o'clock, when the *Suchet* came to our rescue. We were then building a raft."

"Ben" Benson, the carpenter of the *Roraima*, said: "I was on deck, amidships, when I heard an explosion. The captain ordered me to up anchor. I got to the windlass, but when the fire came I went into the forecastle and got my 'duds.' When I came out I talked with Captain Muggah, Mr. Scott, the first officer and others. They had been on the bridge. The captain was horribly burned. He had inhaled flames and wanted to jump into the sea.

I tried to make him take a life-preserver. The captain, who was undressed, jumped overboard and hung on to a line for a while. Then he disappeared."

THE COOPER'S STORY.

James Taylor, a cooper employed on the *Roraima*, gives the following account of his experience of the disaster :

"Hearing a tremendous report and seeing the ashes falling thicker, I dived into a room, dragging with me Samuel Thomas, a gangway man and fellow countryman, shutting the door tightly. Shortly after I heard a voice, which I recognized as that of the chief mate, Mr. Scott. Opening the door with great caution, I drew him in. The nose of Thomas was burned by the intense heat.

"We three and Thompson, the assistant purser, out of sixty-eight souls on board, were the only persons who escaped practically uninjured. The heat being unbearable, I emerged in a few moments, and the scene that presented itself to my eyes baffles description. All around on the deck were the dead and dying covered with boiling mud. There they lay, men, women and little children, and the appeals of the latter for water were heart-rending. When water was given them they could not swallow it, owing to their throats being filled with ashes or burnt with the heated air.

"The ship was burning aft, and I jumped overboard, the sea being intensely hot. I was at once swept seaward by a tidal wave, but, the sea receding a considerable distance, the return wave washed me against an upturned sloop to which I clung. I was joined by a man so dreadfully burned and disfigured as to be unrecognizable. Afterwards I found he was the captain of the *Roraima*, Captain Muggah. He was in dreadful agony, begging piteously to be put on board his ship.

"Picking up some wreckage which contained bedding and a tool chest, I, with the help of five others who had joined me on the wreck, constructed a rude raft, on which we placed the captain. Then, seeing an upturned boat, I asked one of the five, a native of Martinique, to swim and fetch it. Instead of returning to us, he picked up two of his countrymen and went away in the direction of Fort de France. Seeing the *Roddam*, which arrived in port shortly after we anchored, making for the *Roraima*, I said good-bye to the captain and swam back to the *Roraima*.

"The *Roddam*, however, burst into flames and put to sea. I reached the *Roraima* at about half-past 2, and was afterwards taken off by a boat from the French warship *Suchet*. Twenty-four others with myself were taken on to Fort de France. Three of these died before reaching port. A number of others have since died."

Samuel Thomas, the gangway man, whose life was saved by the forethought of Taylor, says that the scene on the burning ship was awful. The groans and cries of the dying, for whom nothing could be done, were horrible. He describes a woman as being burned to death with a living babe in her arms. He says that it seemed as if the whole world was afire.

CONSUL AYME'S STATEMENT

The inflammable material in the forepart of the ship that would have ignited that part of the vessel was thrown overboard by him and the other two uninjured men. The *Grappler*, the telegraph company's ship, was seen opposite the *Usine Guerin*, and disappeared as if blown up by a submarine explosion. The captain's body was subsequently found by a boat from the *Suchet*.

Consul Ayme, of Guadeloupe, who, as already stated, had hastened to Fort de France on hearing of the terrible event, tells the story of the disaster in the following words :

"Thursday morning the inhabitants of the city awoke to find heavy clouds shrouding Mont Pelee crater. All day Wednesday horrid detonations had been heard. These were echoed from St. Thomas on the north to Barbados on the south. The cannonading ceased on Wednesday night, and fine ashes fell like rain on St. Pierre. The inhabitants were alarmed, but Governor Mouttet, who had arrived at St. Pierre the evening before, did everything possible to allay the panic.

"The British steamer *Roraima* reached St. Pierre on Thursday with ten passengers, among whom were Mrs. Stokes and her three children, and Mrs. H. J. Ince. They were watching the rain of ashes, when, with a frightful roar and terrific electric discharges, a cyclone of fire, mud and steam swept down from the crater over the town and bay, sweeping all before it and destroying the fleet of vessels at anchor off the shore. There the accounts of the catastrophe so far obtainable cease. Thirty thousand corpses are strewn about, buried in the ruins of St. Pierre, or else floating, gnawed by sharks, in the surrounding seas. Twenty-eight charred, half-dead human beings were brought here. Sixteen of them are already dead, and only four of the whole number are expected to recover."

A WOMAN'S EXPERIENCE ON THE "RORAIMA"

Margaret Stokes, the 9 year old daughter of the late Clement Stokes, of New York, who, with her mother, a brother aged 4 and a sister aged 3 years, was on the ill-fated steamer *Roraima*, was saved from that vessel, but is not expected to live. Her nurse, Clara King, tells the following story of her experience :

She says she was in her stateroom, when the steward of the *Roraima* called out to her :

"Look at Mont Pelee."

She went on deck and saw a vast mass of black cloud coming down from the volcano. The steward ordered her to return to the saloon, saying, "It is coming."

Miss King then rushed to the saloon. She says she experienced a feeling of suffocation, which was followed by intense heat. The afterpart of the *Roraima* broke out in flames. Ben Benson, the carpenter of the *Roraima*, severely burned, assisted Miss King and Margaret Stokes to escape. With the help of Mr. Scott, the first mate of the *Roraima*, he constructed a raft, with life preservers. Upon this Miss King and Margaret were placed.

While this was being done Margaret's little brother died. Mate Scott brought the child water at great personal danger, but it was unavailing. Shortly after the death of the little boy Mrs. Stokes succumbed. Margaret and Miss King eventually got away on the raft, and were picked up by the steamer *Korona*. Mate Scott also escaped. Miss King did not sustain serious injuries. She covered the face of Margaret with her dress, but still the child was probably fatally burned.

The only woman known at that time to have survived the disaster at St. Pierre was a negress named Fillotte. She was found in a cellar Saturday afternoon, where she had been for three days. She was still alive, but fearfully burned from head to toes. She died afterward in the hospital.

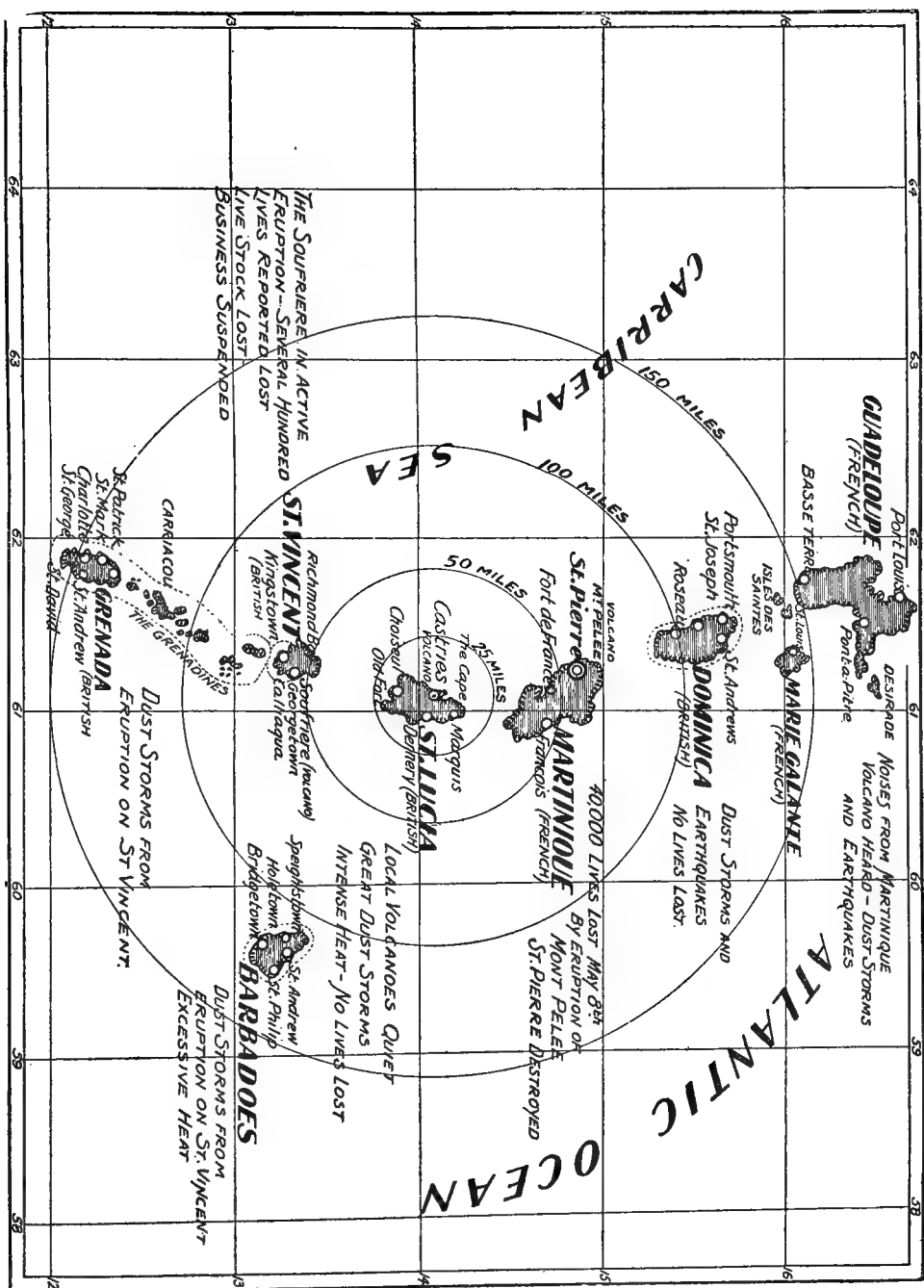
CAPTAIN FREEMAN'S THRILLING ACCOUNT

Of the vessels in the harbor of St. Pierre on the fateful morning, only one, the British steamer *Roddam*, escaped, and that with a crew of whom few reached the open sea alive. Those who did escape were terribly injured. Captain Freeman, of this vessel, tells what he experienced in the following thrilling language :

“St. Lucia, British West Indies, May 11.—The steamer *Roddam*, of which I am captain, left St. Lucia at midnight of May 7, and was off St. Pierre, Martinique, at 6 o'clock on the morning of the 8th. I noticed that the volcano, Mont Pelee, was smoking, and crept slowly in toward the bay, finding there among others the steamer *Roraima*, the telegraph repairing steamer *Grappler* and four sailing vessels. I went to anchorage between 7 and 8 and had hardly moored when the side of the volcano opened out with a terrible explosion. A wall of fire swept over the town and the bay. The *Roddam* was struck broadside by the burning mass. The shock to the ship was terrible, nearly capsizing her.

AWFUL RESULTS

‘Hearing the awful report of the explosion and seeing the great wall of flames approaching the steamer, those on deck sought shelter wherever it was possible, jumping into the cabin, the fore-castle and even into the hold. I was in the chart room, but the burning embers were borne by so swift a movement of the air that they were swept in through the door and port holes, suffocating and scorching me badly. I was terribly burned by these embers about the face and hands, but managed to reach the deck. Then, as soon as it was possible, I mustered the few survivors who seemed able to move, ordered them to slip the anchor, leaped for the bridge and ran the engine for full speed astern. The second and the third engineer and a fireman were on watch below and so escaped injury. They did their part in the attempt to escape, but the men on deck could not work the steering gear because it was jammed by the debris from the volcano. We accordingly went ahead and astern until the gear was free, but in this running backward and forward it was two hours after the first shock before we were clear of the bay.



"One of the most terrifying conditions was that, the atmosphere being charged with ashes, it was totally dark. The sun was completely obscured, and the air was only illuminated by the flames from the volcano and those of the burning town and shipping. It seems small to say that the scene was terrifying in the extreme. As we backed out we passed close to the *Roraima*, which was one mass of blaze. The steam was rushing from the engine room, and the screams of those on board were terrible to hear. The cries for help were all in vain, for I could do nothing but save my own ship. When I last saw the *Roraima* she was settling down by the stern. That was about 10 o'clock in the morning.

"When the *Roddam* was safely out of the harbor of St. Pierre, with its desolations and horrors, I made for St. Lucia. Arriving there, and when the ship was safe, I mustered the survivors as well as I was able and searched for the dead and injured. Some I found in the saloon where they had vainly sought for safety, but the cabins were full of burning embers that had blown in through the port holes. Through these the fire swept as through funnels and burned the victims where they lay or stood, leaving a circular imprint of scorched and burned flesh. I brought ten on deck who were thus burned; two of them were dead, the others survived, although in a dreadful state of torture from their burns. Their screams of agony were heartrending. Out of a total of twenty-three on board the *Roddam*, which includes the captain and the crew, ten are dead and several are in the hospital. My first and second mates, my chief engineer and my supercargo, Campbell by name, were killed. The ship was covered from stem to stern with tons of powdered lava, which retained its heat for hours after it had fallen. In many cases it was practically incandescent, and to move about the deck in this burning mass was not only difficult but absolutely perilous. I am

only now able to begin thoroughly to clear and search the ship for any damage done by this volcanic rain, and to see if there are any corpses in out-of-the-way places. For instance, this morning, I found one body in the peak of the forecastle. The body was horribly burned and the sailor had evidently crept in there in his agony to die.

“On the arrival of the *Roddam* at St. Lucia the ship presented an appalling appearance. Dead and calcined bodies lay about the deck, which was also crowded with injured, helpless and suffering people. Prompt assistance was rendered to the injured by the authorities here and my poor, tortured men were taken to the hospital. The dead were buried. I have omitted to mention that out of twenty-one black laborers that I brought from Grenada to help in stevedoring, only six survived. Most of the others threw themselves overboard to escape a dreadful fate, but they met a worse one, for it is an actual fact that the water around the ship was literally at a boiling heat. The escape of my vessel was miraculous. The woodwork of the cabins and bridge and everything inflammable on deck were constantly igniting, and it was with great difficulty that we few survivors managed to keep the flames down. My ropes, awnings, tarpaulins were completely burned up.

“I witnessed the entire destruction of St. Pierre. The flames enveloped the town in every quarter with such rapidity that it was impossible that any person could be saved. As I have said, the day was suddenly turned to night, but I could distinguish by the light of the burning town people distractedly running about on the beach. The burning buildings stood out from the surrounding darkness like black shadows. All this time the mountain was roaring and shaking, and in the intervals between these terrifying sounds I could hear the cries of despair and agony from the thousands who were perishing. These cries added to the terror of the scene, but

it is impossible to describe its horror or the dreadful sensations it produced. It was like witnessing the end of the world.

“Let me add that, after the first shock was over, the survivors of the crew rendered willing help to navigate the ship to this port. Mr. Plissoneau, our agent in Martinique, happening to be on board, was saved, and I really believe that he is the only survivor of St. Pierre. As it is, he is seriously burned on the hands and face.

“FREEMAN,

“Master British Steamship *Roddam*.”

THE “ETONA” PASSES ST. PIERRE

The British steamer *Etona*, of the Norton Line, stopped at St. Lucia to coal on May 10th. Captain Cantell there visited the *Roddam* and had an interview with Captain Freeman. On the 11th the *Etona* put to sea again, passing St. Pierre in the afternoon. We subjoin her captain's story :

“The weather was clear and we had a fine view, but the old outlines of St. Pierre were not recognizable. Everything was a mass of blue lava, and the formation of the land itself seemed to have changed. When we were about eight miles off the northern end of the island Mount Pelee began to belch a second time. Clouds of smoke and lava shot into the air and spread over all the sea, darkening the sun. Our decks in a few minutes were covered with a substance that looked like sand dyed a bluish tint, and which smelled like phosphorus. For all that the day was clear, there was little to be seen satisfactorily. Over the island there hung a blue haze. It seemed to me that the formation, the topography, of the island was altered.

“Everything seemed to be covered with a blue dust, such as had fallen aboard us every day since we had been within the affected

region. It was blue lava dust. For more than an hour we scanned the coast with our glasses, now and then discovering something that looked like a ruined hamlet or collection of buildings. There was no life visible. Suddenly we realized that we might have to fight for our lives as the *Roddam's* people had done.

"We were about four miles off the northern end of the island when suddenly there shot up in the air to a tremendous height a column of smoke. The sky darkened and the smoke seemed to swirl down upon us. In fact, it spread all around, darkening the atmosphere as far as we could see. I called Chief Engineer Farrish to the deck.

" 'Do you see that over there?' I asked, pointing to the eruption, for it was the second eruption of Mont Pelee. He saw it all right. Captain Freeman's story was fresh in my mind.

" 'Well, Farrish, rush your engines as they have never been rushed before,' I said to him. He went below, and soon we began to burn coal and pile up the feathers in our forefoot.

"I was on watch with Second Officer Gibbs. At once we began to furl awnings and make secure against fire. The crew were all showing an anxious spirit, and everybody on board, including the four passengers, were serious and apprehensive.

"We began to cut through the water at almost twelve knots. Ordinarily we make ten knots. We could see no more of the land contour, but everything seemed to be enveloped in a great cloud. There was no fire visible, but the lava dust rained down upon us steadily. In less than an hour there were two inches of it upon our deck.

"The air smelled like phosphorous. No one dared to look up to try to locate the sun, because one's eyes would fill with lava dust. Some of the blue lava dust is sticking to our mast yet,

although we have swabbed 'decks and rigging again and again to be clear of it.

"After a little more than an hour's fast running we saw daylight ahead and began to breathe easier. If I had not talked with Captain Freeman and heard from him just how the black swirl of wind and fire rolled down upon him, I would not have been so apprehensive, but would have thought that the darkness and cloud that came down upon us meant just an unusually heavy squall.'

CHIEF ENGINEER FARRISH'S STORY

"The *Etona's* run from Montevideo was a fast one—I think a record breaker. We were 22 days and 21 hours from port to port. Off Martinique I stared at the coast for about an hour, and then went below. The blue lava that covered everything faded into the haze that hung over the island so that nothing was distinctly visible. Through my glass I discovered a stream of lava, though. It stretched down the mountain side, and seemed to be flowing into the sea. It was not clearly and distinctly visible, however.

"About 3 o'clock I went below to take forty winks. I had been in my berth only a few minutes when the steward told me the captain wanted me on the bridge.

" 'Do you see that, Farrish?' he asked, pointing at the land. An outburst of smoke seemed to be sweeping down upon us. It made me think of the *Roddam's* experience. Smoke and dust closed in about us, shutting out the sunlight, and precipitating a fall of lava on our decks.

" 'Go below and drive her,' said the captain, and I didn't lose any time, I can tell you. We burned coal as though it didn't cost

a cent. The safety valve was jumping every second, even though we were making twelve knots an hour. For two hours we kept up the pace, and then, running into clear daylight, let the engines slow down and we all cheered up a bit."

CAPTAIN CANTELL VISITS THE "RODDAM"

Captain Cantell went on board the *Roddam*, whose frightful condition he thus describes :

"At St. Lucia, on May 11th, I went on board the British steamship *Roddam*, which had escaped from the terrible volcanic eruption at Martinique two days before. The state of the ship was enough to show that those on board must have undergone an awful experience.

"The *Roddam* was covered with a mass of fine bluish gray dust or ashes of cement-like appearance. In some parts it lay two feet deep on the decks. This matter had fallen in a red-hot state all over the steamer, setting fire to everything it struck that was burnable, and, when it fell on the men on board, burning off limbs and large pieces of flesh. This was shown by finding portions of human flesh when the decks were cleared of the debris. The rigging, ropes, tarpaulins, sails, awnings, etc., were charred or burned, and most of the upper stanchions and spars were swept overboard or destroyed by fire. Skylights were smashed and cabins were filled with volcanic dust. The scene of ruin was deplorable.

"The captain, though suffering the greatest agony, succeeded in navigating his vessel safely to the port of Castries, St. Lucia, with eighteen dead bodies on the deck and human limbs scattered about. A sailor stood by constantly wiping the captain's injured eyes.

"I think the performance of the *Roddam's* captain was most wonderful, and the more so when I saw his pitiful condition. I do

not understand how he kept up, yet when the steamer arrived at St. Lucia and medical assistance was procured, this brave man asked the doctors to attend to the others first and refused to be treated until this was done.

“ My interview with the captain brought out this account. I left him in good spirits and receiving every comfort. The sight of his face would frighten anyone not prepared to see it.”

THE VIVID ACCOUNT OF M. ALBERT

To the accounts given by the survivors of the *Roraima* and the officers of the *Etona*, it will be well to add the following graphic story told by M. Albert, a planter of the island, the owner of an estate situated only a mile to the northeast of the burning crater of Mont Pelee. His escape from death had in it something of the marvellous. He says :

“ Mont Pelee had given warning of the destruction that was to come, but we, who had looked upon the volcano as harmless, did not believe that it would do more than spout fire and steam, as it had done on other occasions. It was a little before eight o'clock on the morning of May 8 that the end came. I was in one of the fields of my estate when the ground trembled under my feet, not as it does when the earth quakes, but as though a terrible struggle was going on within the mountain. A terror came upon me, but I could not explain my fear.

“ As I stood still Mont Pelee seemed to shudder, and a moaning sound issued from its crater. It was quite dark, the sun being obscured by ashes and fine volcanic dust. The air was dead about me, so dead that the floating dust seemingly was not disturbed. Then there was a rending, crashing, grinding noise, which I can only describe as sounding as though every bit of machinery in the

world had suddenly broken down. It was deafening, and the flash of light that accompanied it was blinding, more so than any lightning I have ever seen.

"It was like a terrible hurricane, and where a fraction of a second before there had been a perfect calm, I felt myself drawn into a vortex and I had to brace myself firmly. It was like a great express train rushing by, and I was drawn by its force. The mysterious force levelled a row of strong trees, tearing them up by the roots and leaving bare a space of ground fifteen yards wide and more than one hundred yards long. Transfixed I stood, not knowing in what direction to flee. I looked toward Mont Pelee, and above its apex there appeared a great black cloud which reached high in the air. It literally fell upon the city of St. Pierre. It moved with a rapidity that made it impossible for anything to escape it. From the cloud came explosions that sounded as though all of the navies of the world were in titanic combat. Lightning played in and out in broad forks, the result being that intense darkness was followed by light that seemed to be of magnifying power.

"That St. Pierre was doomed I knew, but I was prevented from seeing the destruction by a spur of the hill that shut off the view of the city. It is impossible for me to tell how long I stood there inert. Probably it was only a few seconds, but so vivid were my impressions that it now seems as though I stood as a spectator for many minutes. When I recovered possession of my senses I ran to my house and collected the members of the family, all of whom were panic stricken. I hurried them to the seashore, where we boarded a small steamship, in which we made the trip in safety to Fort de France.

"I know that there was no flame in the first wave that was sent down upon St. Pierre. It was a heavy gas, like firedamp, and

it must have asphyxiated the inhabitants before they were touched by the fire, which quickly followed. As we drew out to sea in the small steamship, Mont Pelee was in the throes of a terrible convulsion. New craters seemed to be opening all about the summit and lava was flowing in broad streams in every direction. My estate was ruined while we were still in sight of it. Many women who lived in St. Pierre escaped only to know that they were left widowed and childless. This is because many of the wealthier men sent their wives away, while they remained in St. Pierre to attend to their business affairs."

WHAT HAPPENED ON THE "HORACE"

The British steamer *Horace* experienced the effect of the explosion when farther from land. After touching at Barbados, she reached the vicinity of Martinique on May 9th, her decks being covered with several inches of dust when she was a hundred and twenty-five miles distant. We quote engineer Anderson's story:

"On the afternoon of May 8 (Thursday) we noticed a peculiar haze in the direction of Martinique. The air seemed heavy and oppressive. The weather conditions were not at all unlike those which precede the great West Indian hurricanes, but, knowing it was not the season of the year for them, we all remarked in the engine room that there must be a heavy storm approaching.

"Several of the sailors, experienced deep water seamen, laughed at our prognostications, and informed us there would be no storm within the next sixty hours, and insisted that, according to all fo'cas'le indications, a dead calm was in sight.

"So unusually peculiar were the weather conditions that we talked of nothing else during the evening. That night, in the direction of Martinique, there was a very black sky, an unusual thing at

this season of the year, and a storm was apparently brewing in a direction from which storms do not come at this season.

GREAT FLASHES OF LIGHT

"As the night wore on those on watch noticed what appeared to be great flashes of lightning in the direction of Martinique. It seemed as though the ordinary conditions were reversed, and even the fo'cas'le prophets were unable to offer explanations.

"Occasionally, over the pounding of the engines and the rush of water, we thought we could hear long, deep roars, not unlike the ending of a deep peal of thunder. Several times we heard the rumble or roar, but at the time we were not certain as to exactly what it was, or even whether we really heard it.

"There would suddenly come great flashes of light from the dark bank toward Martinique. Some of them seemed to spread over a great area, while others appeared to spout skyward, funnel shaped. All night this continued, and it was not until day came that the flashes disappeared. The dark bank that covered the horizon toward Martinique, however, did not fade away with the breaking of day, and at eight in the morning of the 9th (Friday) the whole section of the sky in that direction seemed dark and troubled.

"About nine o'clock Friday morning I was sitting on one of the hatches aft with some of the other engineers and officers of the ship, discussing the peculiar weather phenomena. I noticed a sort of grit that got into my mouth from the end of the cigar I was smoking.

"I attributed it to some rather bad coal which we had shipped aboard, and, turning to Chief Engineer Evans, I remarked that 'that coal was mighty dirty,' and he said that it was covering the ship with a sort of grit. Then I noticed that grit was getting on

my clothes, and finally some one suggested that we go forward of the funnels, so we would not get dirt on us. As we went forward we met one or two of the sailors from the forecandle, who wanted to know about the dust that was falling on the ship. Then we found that the grayish-looking ash was sifting all over the ship, both forward and aft.

ASHES RAINED ON THE SHIP

“Every moment the ashes rained down all over the ship, and at the same time grew thicker. A few moments later, the lookout called down that we were running into a fog-bank dead ahead. Fog banks in that section are unheard of at nine o'clock in the morning at this season, and we were more than a hundred miles from land, and what could fog and sand be doing there.

“Before we knew it, we went into the fog, which proved to be a big dense bank of this same sand, and it rained down on us from every side. Ventilators were quickly brought to their places, and later even the hatches were battened down. The dust became suffocating, and the men at times had all they could do to keep from choking. What the stuff was we could not at first conjecture, or rather, we didn't have much time to speculate on it, for we had to get our ship in shape to withstand we hardly knew what.

“At first we thought that the sand must have been blown from shore. Then we decided that if the Captain's figures were right we wouldn't be near enough to shore to have sand blow on us, and as we had just cleared Barbados, we knew that the Captain's figures had to be right.

“Just as the storm of sand was at its height, Fourth Engineer Wild was nearly suffocated by it, but was easily revived. About this time it became so dark that we found it necessary to start up the electric lights, and it was not until after we got clear from the

fog that we turned the current off. In the meantime they had burned from nine o'clock in the morning until after two in the afternoon.

THE ENGINE BECAME CHOKED

"Then there was another anxious moment shortly after nine o'clock. Third Engineer Rennie had been running the donkey engine, when suddenly it choked, and when he finally got it clear from the sand or ashes, he found the valves were all cut out, and then it was we discovered that it was not sand, but some sort of a composition that seemed to cut steel like emery. Then came the danger that it would get into the valves of the engine and cut them out, and for several moments all hands scurried about and helped make the engine room tight, and even then the ash drifted in and kept all the engine room force wiping the engines clear of it.

"Toward three o'clock in the afternoon of Friday we were practically clear of the sand, but at eleven o'clock that night we ran into a second bank of it, though not as bad as the first. We made some experiments, and found the stuff was superior to emery dust. It cut deeper and quicker, and only about half as much was required to do the work. We made up our minds we would keep what came on board, as it was better than the emery dust and much cheaper, so we gathered it up.

"That night there were more of the same electric phenomena toward Martinique, but it was not until we got into St. Lucia, where we saw the *Roddam*, that we learned of the terrible disaster at St. Pierre, and then we knew that our sand was lava dust."

The volcanic ash which fell on the decks of the *Horace* was ground as fine as rifle powder, and was much finer than that which covered the decks of the *Etona*.

Returning to the stories told by officers of the *Roraima*, of which a number have been given, it seems desirable to add here the narrative of Ellery S. Scott, the mate of the ruined ship, since it gives a vivid and striking account of his personal experience of the frightful disaster, with many details of interest not related by others.

MATE SCOTT'S GRAPHIC STORY

"We got to St. Pierre in the *Roraima*," began Mr. Scott, "at 6.30 o'clock on Thursday morning. That's the morning the mountain and the town and the ships were all sent to hell in a minute.

"All hands had had breakfast. I was standing on the fo'c's'l head trying to make out the marks on the pipes of a ship 'way out and heading for St. Lucia. I wasn't looking at the mountain at all. But I guess the captain was, for he was on the bridge, and the last time I heard him speak was when he shouted, 'Heave up, Mr. Scott; heave up.' I gave the order to the men, and I think some of them did jump to get the anchor up, but nobody knows what really happened for the next fifteen minutes. I turned around toward the captain and then I saw the mountain.

"Did you ever see the tide come into the Bay of Fundy. It doesn't sneak in a little at a time as it does 'round here. It rolls in in waves. That's the way the cloud of fire and mud and white-hot stones rolled down from that volcano over the town and over the ships. It was on us in almost no time, but I saw it and in the same glance I saw our captain bracing himself to meet it on the bridge. He was facing the fire cloud with both hands gripped hard to the bridge rail, his legs apart and his knees braced back stiff. I've seen him brace himself that same way many a time in a tough sea with the spray going mast-head high and green water pouring along the decks.

"I saw the captain, I say, at the same instant I saw that ruin coming down on us. I don't know why, but that last glimpse of poor Muggah on his bridge will stay with me just as long as I remember St. Pierre and that will be long enough.

"In another instant it was all over for him. As I was looking at him he was all ablaze. He reeled and fell on the bridge with his face toward me. His mustache and eyebrows were gone in a jiffy. His hat had gone, and his hair was aflame, and so were his clothes from head to foot. I knew he was conscious when he fell, by the look in his eyes, but he didn't make a sound.

"That all happened a long way inside of half a minute ; then something new happened. When the wave of fire was going over us, a tidal wave of the sea came out from the shore and did the rest. That wall of rushing water was so high and so solid that it seemed to rise up and join the smoke and flame above. For an instant we could see nothing but the water and the flame.

"That tidal wave picked the ship up like a canoe and then smashed her. After one list to starboard the ship righted, but the masts, the bridge, the funnel and all the upper works had gone overboard.

"I had saved myself from fire by jamming a metal ventilator cover over my head and jumping from the fo'c's'l head. Two St. Kitts negroes saved me from the water by grabbing me by the legs and pulling me down into the fo'c's'l after them. Before I could get up three men tumbled in on top of me. Two of them were dead.

"Captain Muggah went overboard, still clinging to the fragments of his wrecked bridge. Daniel Taylor, the ship's cooper, and a Kitts native jumped overboard to save him. Taylor managed to push the captain on to a hatch that had floated off from us and then they swam back to the ship for more assistance, but nothing could be

done for the captain. Taylor wasn't sure he was alive. The last we saw of him or his dead body it was drifting shoreward on that hatch.

"Well, after staying in the fo'c's'l about twenty minutes, I went out on deck. There were just four of us left aboard who could do anything. The four were Thompson, Dan Taylor, Quashee, and myself. It was still raining fire and hot rocks and you could hardly see a ship's length for dust and ashes, but we could stand that. There were burning men and some women and two or three children lying around the deck. Not just burned, but burning, then, when we got to them. More than half the ship's company had been killed in that first rush of flame. Some had rolled overboard when the tidal wave came and we never saw so much as their bodies. The cook was burned to death in his galley. He had been paring potatoes for dinner and what was left of his right hand held the shank of his potato knife. The wooden handle was in ashes. All that happened to a man in less than a minute. The donkey engineman was killed on deck sitting in front of his boiler. We found parts of some bodies—a hand, or an arm or a leg. Below decks there were some twenty alive.

"The ship was on fire, of course, what was left of it. The stumps of both masts were blazing. Aft she was like a furnace, but forward the flames had not got below deck, so we four carried those who were still alive on deck into the fo'c's'l. All of them were burned and most of them were half strangled.

"One boy, a passenger and just a little shaver [the four-year-old son of the late Clement Stokes, above spoken of] was picked up naked. His hair and all his clothing had been burned off, but he was alive. We rolled him in a blanket and put him in a sailor's bunk. A few minutes later we looked at him and he was dead.

"My own son's gone, too. It had been his trick at lookout ahead during the dog watch that morning, when we were making for St. Pierre, so I supposed at first when the fire struck us that he was asleep in his bunk and safe. But he wasn't. Nobody could tell me where he was. I don't know whether he was burned to death or rolled overboard and drowned. He was a likely boy. He had been several voyages with me and would have been a master some day. He used to say he'd make me mate.

"After getting all hands that had any life left in them below and 'tended to the best we could, the four of us that were left half way ship-shape started in to fight the fire. We had case oil stowed forward. Thanks to that tidal wave that cleared our decks there wasn't much left to burn, so we got the fire down so's we could live on board with it for several hours more and then the four turned to to knock a raft together out of what timber and truck we could find below. Our boats had gone overboard with the masts and funnel.

PREPARED TO TRUST TO LUCK

"We made that raft for something over thirty that were alive. We put provisions on for two days and rigged up a make-shift mast and sail, for we intended to go to sea. We were only three boats' length from the shore, but the shore was hell itself. We intended to put straight out and trust to luck that the *Korona*, that was about due at St. Pierre, would pick us up. But we did not have to risk the raft, for about 3 o'clock in the afternoon, when we were almost ready to put the raft overboard, the *Suchet* came along and took us all off. We thought for a minute just after we were wrecked that we were to get help from a ship that passed us. We burned blue lights, but she kept on. We learned afterward that she was the *Roddam*."

Soundings made off Martinique after the explosion showed that earthquake effects of much importance had taken place under the sea bottom, which had been lifted in some places and had sunk in others. While deep crevices had been formed on the land, a still greater effect had seemingly been produced beneath the water. During the explosion the sea withdrew several hundred feet from its shore line, and then came back steaming with fury ; this indicating a lift and fall of the ocean bed off the isle. Soundings made subsequently near the island found in one place a depth of 4,000 feet where before it had been only 600 feet deep. The French Cable Company, which was at work trying to repair the cables broken by the eruption, found the bottom of the Caribbean Sea so changed as to render the old charts useless.

New charts will need to be made for future navigation. The changes in sea levels were not confined to the immediate centre of volcanic activity, but extended as far north as Porto Rico, and it was believed that the seismic wave would be found to have altered the ocean bed round Jamaica. Vessels plying between St. Thomas, Martinique, St. Lucia and other islands found it necessary to heave the lead while many miles at sea.

It is estimated that the sea had encroached from ten feet to two miles along the coast of St. Vincent near Georgetown, and that a section on the north of the island had dropped into the sea. Soundings showed seven fathoms where before the eruption there were thirty-six fathoms of water. Vessels that endeavored to approach St. Vincent toward the north reported that it was impossible to get nearer than eight miles to the scene of the catastrophe, and that at that distance the ocean was seriously perturbed as from a submarine volcano, boiling and hissing continually.

In this connection the remarkable experience reported by the officers of the Danish steamship *Nordby*, on the day preceding the eruption, is of much interest, as seeming to show great convulsions of the sea bottom at a point several hundred miles from Martinique. The following is the story told by Captain Eric Lillien-skjold :

THE STRANGE EXPERIENCE OF THE "NORDBY"

"On May 5th," the captain said, "we touched at St. Michael's for water. We had had an easy voyage from Girgenti, in Sicily, and we wanted to finish an easy run here. We left St. Michael's on the same day. Nothing worth while talking about occurred until two days afterward—Wednesday, May 7th.

"We were plodding along slowly that day. About noon I took the bridge to make an observation. It seemed to be hotter than ordinary. I shed my coat and vest and got into what little shade there was. As I worked it grew hotter and hotter. I didn't know what to make of it. Along about 2 o'clock in the afternoon it was so hot that all hands got to talking about it. We reckoned that something queer was coming off, but none of us could explain what it was. You could almost see the pitch softening in the seams.

"Then, as quick as you could toss a biscuit over its rail, the *Nordby* dropped—regularly dropped—three or four feet down into the sea. No sooner did it do this than big waves, that looked like they were coming from all directions at once, began to smash against our sides. This was queerer yet, because the water a minute before was as smooth as I ever saw it. I had all hands piped on deck, and we battened down everything loose to make ready for a storm. And we got it all right—the strangest storm you ever heard tell of.

“There was something wrong with the sun that afternoon. It grew red and then dark red and then, about a quarter after 2, it went out of sight altogether. The day got so dark that you couldn’t see half a ship’s length ahead of you. We got our lamps going, and put on our oilskins, ready for a hurricane. All of a sudden there came a sheet of lightning that showed up the whole tumbling sea for miles and miles. We sort of ducked, expecting an awful crash of thunder, but it didn’t come. There was no sound except the big waves pounding against our sides. There wasn’t a breath of wind.

“Well, sir, at that minute there began the most exciting time I’ve ever been through, and I’ve been on every sea on the map for twenty-five years. Every second there’d be waves 15 or 20 feet high, belting us head-on, stern-on and broadside, all at once. We could see them coming, for without any stop at all flash after flash of lightning was blazing all about us.

“Something else we could see, too. Sharks! There were hundreds of them on all sides, jumping up and down in the water. Some of them jumped clear out of it. And sea birds! A flock of them, squawking and crying, made for our rigging and perched there. They seemed like they were scared to death. But the queerest part of it all was the water itself. It was hot—not so hot that our feet could not stand it when it washed over the deck, but hot enough to make us think that it had been heated by some kind of a fire.

“Well that sort of thing went on hour after hour. The waves, the lightning, the hot water and the sharks, and all the rest of the odd things happening, frightened the crew out of their wits. Some of them prayed out loud—I guess the first time they ever did in their lives. Some Frenchmen aboard kept running around and

yelling, '*C'est le dernier jour !*' (This is the last day.) We were all worried. Even the officers began to think that the world was coming to an end. Mighty strange things happen on the sea, but this topped them all.

"I kept to the bridge all night. When the first hour of morning came the storm was still going on. We were all pretty much tired out by that time, but there was no such thing as trying to sleep. The waves still were batting us around and we didn't know whether we were one mile or a thousand miles from shore. At 2 o'clock in the morning all the queer goings on stopped just the way they began—all of a sudden. We lay to until daylight; then we took our reckonings and started off again. We were about 700 miles off Cape Henlopen.

"No, sir; you couldn't get me through a thing like that again for \$10,000. None of us was hurt, and the old *Nordby* herself pulled through all right, but I'd sooner stay ashore than see waves without wind and lightning without thunder."

FIERY STREAM CONTAINED POISONOUS GASES

Careful inspection showed that the fiery stream which so completely destroyed St. Pierre must have been composed of poisonous gases, which instantly suffocated every one who inhaled them, and of other gases burning furiously, for nearly all the victims had their hands covering their mouths, or were in some other attitude showing that they had perished from suffocation.

It is believed that Mont Pelee threw off a great gasp of some exceedingly heavy and noxious gas, something akin to firedamp, which settled upon the city and rendered the inhabitants insensible. This was followed by the sheet of flame that swept down the side of the mountain. This theory is sustained by the experience of the

survivors who were taken from the ships in the harbor, as they say that their first experience was one of faintness.

The dumb animals were wiser than man, and early took warning of the storm of fire which Mont Pelee was storing up to hurl upon the island. Even before the mountain began to rumble, late in April, live stock became uneasy, and at times were almost uncontrollable. Cattle lowed in the night. Dogs howled and sought the company of their masters, and when driven forth they gave every evidence of fear.

Wild animals disappeared from the vicinity of Mont Pelee. Even the snakes, which at ordinary times are found in great numbers near the volcano, crawled away. Birds ceased singing and left the trees that shaded the sides of Pelee. A great fear seemed to be upon the island, and though it was shared by the human inhabitants, they alone neglected to protect themselves.

Of the villages in the vicinity of St. Pierre only one escaped, the others suffering the fate of the city. The fortunate one was Le Carbet, on the south, which escaped uninjured, the flood of lava stopping when within two hundred feet of the town. Morne Rouge, a beautiful summer resort, frequented by the people of the island during the hot season as a place of recreation, also escaped. In the height of the season several thousand people gathered there, though at the time of the explosion there were but a few hundred. Though located on an elevation between the city and the crater, it was by great good fortune saved.

The Governor of Martinique, Mr. Mouttet, whose precautions to prevent the people fleeing from the city aided to make the work of death complete, was himself among the victims of the burning mountain. With him in this fate was Colonel Dain, commander of the troops who formed a cordon round the doomed city.

CHAPTER V.

An Island in Ruins and the Work of Research.

QUICKLY as possible after the terrible disaster of May 8th, which left the formerly thriving and active city of St. Pierre a heap of smoking and blazing ruins, peopled only by the dead, the work of rescue and research began. The French cable-repair ship *Pouyer Quertier*, Captain Thuron, lost no time in starting on a mission of rescue, in which it had to pass through clouds of burning cinders, at the risk of catching fire, in order to reach the terror-stricken people ashore. But the captain succeeded in bringing to Fort de France 456 people, mainly former residents of the village of Le Precheur

This was on Saturday, the 9th. Later this steamer, as the result of other daring trips, succeeded in bringing many more persons to Fort de France. On Sunday she rescued 923 persons and piloted the French cruiser *Suchet* and the Danish cruiser *Valkyrien*, which took on board 1,500 persons. She distributed to the sufferers large quantities of biscuits, milk, wine and cheese.

THE "SUCHET" AT ST. PIERRE

The French cruiser *Suchet* was the first to approach the ruined port. This was on the evening of Thursday, the day of the disaster. During the earlier part of that day the heat was so intense and the volcano so active, that it was impossible to venture near the town. As evening came on the *Suchet*, after a heroic battle

with the heat, suffocation and sulphur fumes, made a dash toward the shore, nearing the land close enough to enable her to take off thirty survivors from the burning ships, most of them being horribly burned and mutilated. Nine of them died while on their way to the hospital. St. Pierre at that time was an absolute, smoking waste, concealing 30,000 corpses, whose rapid decomposition would necessitate a quick completion of their cremation, which was only partially accomplished by the lava.

On the 10th, the *Suchet* succeeding in getting a landing party ashore, the work of research began. The captain reported the town to be a mere heap of ruins, under which the great multitude of the victims of the catastrophe were buried. On Sunday several steamers, including the government vessel *Rubis*, started from Fort de France for St. Pierre, ten miles distant. The steamers had on board a government delegate, a number of gendarmes, a detachment of regular infantry and several priests. The vessel also carried a quantity of firewood, petroleum and quicklime, for use in the cremation of the bodies of the victims of the terrible volcanic outbreak of Thursday.

IN THE RUINED CITY

As the ships came near, the sea seemed covered with the wreckage of the vessels sunk in the harbor, while on shore only a few trees, all bent seaward by the force of the volcanic shower, were left standing. When nearing St. Pierre the *Rubis* met a number of tugs towing lighters filled with refugees. The heat from the smoking lava-covered ruins at St. Pierre was suffocating, and the stench from the corpse-strewn streets was awful. Only a few walls were erect. The hospital clock was found intact, with its hands stopped at 7.50. On all sides were found portions of corpses, which

were gathered up by the soldiers and gendarmes and burned on one of the public squares. Not a drop of water was procurable ashore. The darkness caused by the clouds of volcanic dust shrouded the town, and continuous subterranean rumblings added to the horror of the scene.

The fort and central quarters of the town were razed to the ground, and were replaced by beds of hot cinders. The iron-grill-work gate of the government offices was alone standing. There was no trace of the streets. Huge heaps of smoking ashes were to be seen on all sides. At the landing place some burned and ruined walls indicated the spot where the custom-house formerly stood, and ruins of larger shops could be seen. In that neighborhood hundreds of dead bodies were found lying in all kinds of attitudes, showing that the victims had met death as if by a lightning stroke. Every vestige of clothing was absent from the charred bodies, and in many cases the abdomens had been burst open by the intense heat. Curiously enough, the features of the dead were generally calm and reposeful, although in some cases terrible fright and agony were depicted. Grim piles of bodies were stacked everywhere, showing that death had stricken them while the crowds were vainly seeking escape from the fiery deluge. On one spot a group of children were found locked in each others' arms.

CREMATING THE DEAD IN HEAPS

Almost the first thing done was to make preparations for the cremation of the dead. Fatigue parties of soldiers built enormous pyres of wood and branches of trees, upon which they heaped the dead bodies by scores and burned them as rapidly as possible.

To facilitate the combustion and to destroy as far as possible the awful odor of burning flesh which came from them, the

impromptu crematories were heavily soaked with coal tar and petroleum. So repulsive was the work, owing to the almost insupportable stench from the already fast decomposing bodies, that the soldiers had to be forced to act. Great fires were kept going day and night, the glow of the funeral pyres being so great that it could be seen from the island of St. Lucia.

As the fires which consumed the city gradually burnt themselves out, it became possible to dig down into the ruins, thus revealing new horrors which had hitherto been buried beneath the volcanic ash and the fallen walls. Ashes and cinders, in places six feet deep, hid the lines of the streets, and covered thousands of decaying corpses.

The path of the volcanic torrent which swept over St. Pierre was marked out in a strange manner. The vicinity of the shore, where vessels anchored, had been swept by a whirlwind of volcanic gas, which ripped, tore and shattered everything in its passage, but left few traces of cinders behind. The tremendous force of the volcanic avalanche was shown by the fact that walls which had stood half a century were leveled like pasteboard. The place was as a city swept by a cyclone of fire. The deluge must have rushed upon the town with resistless force. On the other hand, the fort, centre and adjoining ports of St. Pierre were buried under a thick bed of cinders, which had consumed everything beneath it. The vaults of the bank of Martinique, at the head of what had been the Rue de L'Hospital, were found intact. They contained \$500,000 in specie and other securities, which was sent to Fort de France for safe keeping. An effort was made also to reach the vaults of the government treasury, in the hope that a large amount of money and other valuables, deposited by the principal merchants of the city, might be saved, but this treasure lay under a heap of volcanic debris six to eight yards deep, and had to be left for later research.

Only three persons were taken alive from the ruined city, and of these two quickly died. One of these was the negress Fillotte, of whose rescue and subsequent death we have spoken. A second was a woman named Laurent, who was employed as a servant at St. Pierre in the household of M. Gabriel, and who was among those taken to the hospital in Fort de France. In describing her experiences she said that on the day of the terrible disaster she heard a loud report, and thereupon fainted. When she regained her senses a few hours later she was horribly burned. Glancing around, she saw two members of the Gabriel family still alive, but they died before assistance could reach them.

She lived for some time after being taken to the hospital, and was conscious while under the care of the physicians, but died without being able to impart any additional information.

In truth, only a single human being escaped from the city after the explosion in condition to survive, and he did so only after passing through a living death. This man, Joseph Surtout by name, was a negro murderer, who was locked in a cell so far under ground that the gases, as well as the flames, failed to reach him. There he remained for four days before his cries were heard.

During these terrible days he was without food and water, almost without air. He saw nothing, his cell being without a window, but he knew from the noise and heat that something extraordinary had happened. He shouted for aid, and as the days passed he commended his soul to God, expecting death.

On the fourth day, though he had lost track of time, he heard voices and shouted and prayed until he had attracted the people. The cell door was broken open and his tomb gave up its dead. As soon as the cell door was open he dashed away like one crazed by his sufferings. Though sadly shaken, he was physically strong.

It seems a singular fact, a remarkable dispensation of Providence shall we say, that the only survivor from the overwhelmed city was one condemned to death by human law for his crimes, yet saved alone of the many thousands who made it their home to tell the story of its awful fate. Where man had proposed, God had disposed. Certainly, after his four days of terrible suffering it would seem that he should be relieved from further penalty from his his crime.

REMARKABLE INCIDENTS

Various strange and incomprehensible incidents were observed at St. Pierre. The charred remains of a woman, with a silk handkerchief unburned and in perfect condition held to her lips, were found there. The crisp bodies of girls were also found, the shoes they wore being unhurt. Side by side with bodies burned to a crisp were bodies but slightly burned. Some articles of clothing on the dead were scarcely scorched. Purses were found almost intact.

Many of the bodies were so burned as to make identification impossible, but in other cases the opposite was the case, some being identified by the searching parties, which were all under military control and their work conducted under orders, while military rule was established in the town to prevent vandals from working and to protect such property as had not been destroyed. Pillagers, indeed, were quickly at work, though orders had been given to shoot down any person who was seen robbing a body. Some of these belonged to the inland district, but others had come from Fort de France in boats in search of booty from the dead.

THE ASSOCIATED PRESS STEAMER

The steamer sent by the Associated Press from Guadeloupe reached St. Pierre at an early hour on Sunday morning. The following is the story told by those on board :—

The island of Martinique, with its lofty hills, was hidden behind a huge veil of violet or leaden-colored haze. Enormous quantities of the wreckage of large and small ships and houses strewn the surface of the sea. Huge trees, and too often bodies, with flocks of sea gulls soaring above and hideous sharks fighting about them, were floating here and there. From behind the volcanic veil came blasts of hot wind, mingled with others icy cold.

At Le Precheur, five miles north of St. Pierre, men and women in canoes, frantic to get away, begged for a passage on the steamer. The whole north end of the island was covered with a silver-grey coating of ashes resembling dirty snow. Furious blasts of fire, ashes and mud swept over the steamer, but, finally, St. Pierre was reached.

The city of St. Pierre stretched nearly two miles along the water front and half a mile back to a cliff at the base of the volcano. The houses of the richer French families were built of stone. The still smoking volcano towered above the ash-covered hills. The ruins were burning in many places, and frightful odors of burned flesh filled the air.

With great difficulty a landing was effected. Not one house was left intact. Viscid heaps of mud, of brighter ashes, or piles of volcanic stones were seen on every side. The streets could hardly be traced. Here and there amid the ruins were heaps of corpses. Almost all the faces were downward. In one corner twenty-two bodies of men, women and children were mingled in one awful mass, arms and legs protruding as the hapless beings had fallen in the last struggles of death's agony.

Through the middle of the old Place Bertin ran a tiny stream, the remains of the River Gayave. Great trees, with roots upward and scorched by fire, were strewn in every direction. Huge blocks and still hot stones were scattered about. From under one large stone

the arm of a white woman protruded. Most notable was the utter silence and the overpowering stench from the thousands of dead.

Careful inspection indicated that the fiery stream which so completely destroyed St. Pierre must have been composed of poisonous gases, which instantly suffocated every one who inhaled them, and of other gases burning furiously, for nearly all the victims had their hands covering their mouths or were in some other attitude showing that they had sought relief from suffocation. All the bodies were carbonized or roasted.

SIGNOR PARAVICINO SEEKS HIS DAUGHTER.

Fortunately, although Mont Pelee continued in a state of eruption for many days, the winds became southerly and the smoke and the greater part of the heavier matter thrown out was borne away to the northward. This somewhat relieved the working parties in St. Pierre, and made a more careful examination of the ruins possible. A trip was made through the ruined city and through the adjacent villages with the searching party organized by Signor Paravicino, the Italian Consul at Barbados, whose daughter was visiting there, and who perished in the disaster. There was some doubt at first concerning the identity of the remains, but this was set at rest by relatives and friends identifying the clothing. This was another example of the curious effects of the fire that swept over the town, bodies being burned beyond all recognition, but the clothing of flimsy material being little damaged.

The body of Signor Paravicino's daughter was found near the village of Carbet, a suburb of St. Pierre. The scenes around the residence where the girl had been visiting were worse than in St. Pierre itself. In the latter place the victims were mostly covered with ashes and other debris. Near Carbet were found 500 bodies

that were terribly distorted and in an advanced state of decomposition. These bodies were counted around the house in which Signorina Paravicino was found, and on the adjacent land. Nearly all the dead were lying on their faces on the ground. Those found in the ruins of dwellings were badly charred.

INCIDENTS OF THE CATASTROPHE.

The body of a woman was found in a nearby stream, to which she had apparently fled in the hope of saving herself from the fiery flood, but even the waters were hot, and no doubt she perished with great suffering and agony. A large heap of bodies was found in one spot. They were apparently those of servants, who had huddled together in great terror of the destruction which overtook them. A large and stately residence close by, but shielded partly by a hill on the St. Pierre side, escaped almost untouched. The windows and inside blinds of this solitary house were gone, but inside the furniture, papers, books, clothing and flooring were mostly unscathed.

The only living thing seen in this district was an ox, thin as a skeleton. While the body of Signorina Paravicino was being prepared for removal this animal stalked slowly through the wreckage to the beach, where it drank sea water and then went back up the hillside. By the roadside, the remains of a man and horse were passed, and others were visible lying about.

Further on was seen the body of a man at the foot of a statue of the Virgin, he apparently having been killed while praying. A large statue of the Virgin on the hill above St. Pierre was hurled yards distant from its base. This, together with the fact that huge trees were torn up by their roots and laid flat, scarcely one being left standing, and other indications, show that the wave of fire must

have passed over this section of the island at hurricane velocity. Every house in St. Pierre, not excepting those that were most solidly built of stone, was absolutely in ruins. The streets were piled twelve feet high with debris and hundreds of dead bodies could be seen in every direction.

The wrecked cathedral was visited, or rather the site where the cathedral had stood. A portion of the tower was standing. The large bell lay in the centre of the ruins. The greater part of the altar had been destroyed, but the golden chalices were still there, damaged, however, by falling debris. In one large chalice were seen the ashes of what had been the Host. A small chalice was full of wafers, not one of which was even scorched.

ESCAPE OF A FAMILY

It is known that many persons who sought refuge in the cathedral perished, but their bodies were scarcely visible, being covered with the debris. When other places were visited, including the sites of the club, the bank, the bourse, the telegraph office, and the principal shops, everywhere was the same scene of desolation and death, such as eye of man had never seen, unless it were when Pompeii and its ruins were uncovered centuries after the eruption. At what was formerly the police station, there was a large pile of bodies lying face downward as if the victims had fallen while in the act of running to escape the fate impending over them.

Of the residents of St. Pierre, there seems to have been only one family that fled from the doomed city on the morning of its destruction before the explosion. This was that of Ferdinand Clerc, a wealthy inhabitant of the island, and Mayor of Trinité, who with his wife and four children succeeded in escaping.

On the morning of May 8, M. Clerc noticed with alarm that the rumblings from Mont Pelee were more pronounced than they had been up to that time. The barometer in his house also fluttered violently, and he at once ordered his servants to harness mules to his carriage and prepare for flight. He advised all his friends to hasten away also, but his advice was disregarded, and he left behind him at his house twenty-eight persons who had gathered there at his call, and whom he advised to get away as quickly as they could.

MR. PRENTIS WARNED IN VAIN.

As Clerc and his family were leaving St. Pierre he saw Mr. Prentis, the American Consul, standing with Mrs. Prentis in front of his house. He called out to Prentis and warned him to flee the city at once, but the Consul only laughed and waved his hand, as he answered: "Oh, there is no danger ; don't be afraid."

When Clerc reached Morne Rouge, distant from St. Pierre about six miles, he looked back, and to his horror saw a huge mass of slate-colored stones and ashes burst from Mont Pelee and tumble down on St. Pierre. This was immediately followed by a great wall of flame, which seemed to rise and topple over on the doomed town. The whole thing lasted not more than two minutes. So sharply defined was the wall of flame that a bull caught on the edge of its track was roasted to a crisp on one side and not a hair of the animal was singed on the other.

A gardener at the village of Morne Rouge saw, at the moment of the disaster, seven luminous points on Mont Pelee. He says he had the impression of being violently drawn toward the volcano by a powerful current of air. Then the mountain opened, according to the description of the gardener, and flung tornadoes of fire at St. Pierre.

At the time of the explosion of the mountain—for the eruption can be likened to nothing else—a man named Lasserne, with a companion, was entering St. Pierre in a small carriage drawn by a pair of mules. The mules were instantly killed and Lasserne and his friend were severely burned, but the coachman, who was driving the carriage, and who was between the mules and the two men, was not burned or injured in the least.

PILLAGERS IN THE RUINS

As the work of exploration of the ruined city proceeded, the bands of pillagers already spoken of became bolder and more numerous. A fierce fight took place between the troops and the looters, and little mercy was shown the heartless wretches when caught. Two of them, who fled when discovered at their work by the troops, were shot, and a considerable number, who were arrested and taken to Fort de France, were sentenced to five years' imprisonment. There were several women among them, who received lighter sentences.

While coming to Fort de France, the U. S. vessel *Potomac* picked up a boat containing five colored and one white man whose pockets were filled with coin and jewelry, the latter evidently stripped from the fingers of the dead. These men were arrested and turned over to the commander of the French cruiser *Suchet* for punishment. An English officer, who took some of the sacred vessels from the cathedral, was suspected of an attempt at robbery, though it proved that his purpose was to preserve them.

In spite of the almost complete destruction, valuables were everywhere exposed, rich temptations for thieving invaders. Goods in the storehouses had been burned and destroyed, but much that was of value remained to be preyed upon by thieves. In

the search of the ruins many safes of business houses were found open, some of them probably forced open by thieves.

After pillaging had been put down in St. Pierre by the vigilance of the guards, it made its appearance in the rural districts, where many houses had been abandoned by the inmates. A number of these were robbed and burned. The country was not policed, and all persons were obliged to go armed as a protection against the bands of negro robbers who terrorized the district. Sugar-cane fields were burned and people openly assaulted, the outlaws adding new terrors to those which the islanders had so recently experienced. Soldiers were sent with orders to take some measures to put a stop to these villainous proceedings.

FLIGHT OF THE COUNTRY PEOPLE

While the citizens of St. Pierre were whelmed under indiscriminating death, the inhabitants of the country districts farther removed from the fire-spouting mountain, yet on whose homes and fields thick dust and cinders were pouring down in devastating layers, fled in terror from their dwellings, making their way towards the seaport of Fort de France as the nearest place of safety.

Hundreds from the seashore districts were lost in a maddened flight from the island, which they attempted in small boats. From the survivors it was learned that in the insane panic that followed the eruption the people seized upon even the frailest boats to get away. In this way many were lost who might otherwise have been saved. Numbers were taken off by the vessels that sought the scene of disaster, but these were insufficient to rescue the multitude of fugitives.

The fear that the end of the world had come had seized upon nearly all, and the only thought of many of them was to get off

the stricken island, which seemed to them to be enveloped in fire from one end to the other. In the villages near St. Pierre visited by the relief parties, the refugees pleaded to be taken to Fort de France. They were half-clad, wild-eyed and hungry. The experiences of the past four days had preyed terribly upon them. Some of them were hysterical.

Thousands of refugees gathered in a few days at Fort de France, clamoring for food, of which the supply was far too limited for the demand. The *Potomac* brought a ton of supplies from San Juan, partly made up of codfish and flour, but days passed before the danger of famine was relieved by the coming of food vessels from more distant ports. Many deaths occurred, and the physicians who reached the island found abundant work to do.

Every praise was given United States Consul Ayme, who worked indefatigably to succor the survivors. He bandaged the limbs of the wounded and worked without sleep and without food until thoroughly exhausted by his labors of charity and beneficence.

THE LURID WORK OF MONT PELEE

Meanwhile in St. Pierre work in the ruins was dangerous and was prosecuted with the greatest difficulty. Crumbling walls were a serious menace to working parties, many urging that what remained of the city should be levelled with dynamite. Even when bodies were found their identification was difficult or impossible. Inhabitants of districts near St. Pierre were forced to quit their homes on account of the odors from the dead and gaseous emanations from the volcanic craters, and the whole situation was attended with every feature of repulsion and peril.

The death-dealing crater, though it had quieted somewhat after the great eruption, still sent up ashes and flames which kept

the people in a state of alarm. After the lapse of a week its frightful energy showed signs of renewal and the terror of the people increased. A press correspondent on May 16 sent the following report :—

“ I passed the island of Martinique this morning in the Royal Mail steamship *Ware*. A new volcano had evidently broken out to the north of Mont Pelee. We followed the usual course from Dominica to St. Lucia and could see the mountain sending up dense black smoke.

“ As we approached nearer to the leeward of the volcano the land became hidden by the smoke, but a red glow shone through the smoke down to the water's edge. I could plainly see a shower of sand and ashes falling, and the smell of sulphur was very strong. It became so offensive that it made our helmsman and the captain ill and forced them to run the steamer five miles out to sea to avoid the sulphurous fumes. When we were well out of the sulphur-laden atmosphere we turned and ran in toward St. Pierre.

‘ Mont Pelee had evidently been throwing out large quantities of lava since I saw the volcano last. I got a good view of St. Pierre and the countryside. I could see where new ravines had been formed, fissures opened, and old ones filled up. The whole face of the country was changing. The scene of desolation was indescribable. A nearer view of St. Pierre shows its ruins in ghastly nakedness.”

NEW VIOLENCE OF ERUPTION

On the succeeding days the violence of the eruption increased, and the people of Morne Rouge, who had hitherto escaped injury, fled for their lives, eight hundred of them starting to walk through the mountains to Fort de France, fifteen miles away. Others of them sought St. Pierre, where they begged frantically to be taken

off by the ships in the harbor. The panic even reached Fort de France, on which city thick showers of dust fell all afternoon and night, while many thousands of people rushed in a panic through the streets, seeking to escape what seemed impending ruin.

Ashes were spouted in great clouds from the crater all day on the 18th. The explosion began on the early morning, when a black column rose above Mont Pelee, accompanied by internal rumblings and a tremor of the earth that sent the sea back from the land in powerful waves.

This column was first caught by a current of air that carried it northward. Then an upper air current swept it back in the opposite direction. Thus it made an immense and well-formed "T," the base of which rested in a cup of flame on the crest of the volcano, from which it sprang. Then the wind veered, and a mantle of darkness was swept westward across the island, enveloping Fort de France, upon which volcanic dust fell to a depth of more than an inch and a half.

So heavy was the dust that filled the air that respiration became a labor, and a fear of suffocation came upon the inhabitants. Great alarm continued for more than four hours, and it was not until the cloud of ashes blew out to sea that confidence was restored.

LIKE A GIGANTIC BLAST FURNACE

All night the summit of Mont Pelee had the appearance of a gigantic blast furnace, at which great forces were working. Flames shot skyward in sheets that at times lighted up the entire island. For a few minutes the fires would drop back into the mouth of the crater, only to reissue with redoubled force.

On the 19th, the American cruiser *Cincinnati*, the naval tug *Potomac*, and the British cruiser *Indefatigable*, left Fort de France

for St. Pierre, in an endeavor to recover the remains of Thomas T. Prentis, the American Consul, and James Japp, the British Consul, whose bodies had been found at their respective consulates, after a long and baffling search. The purpose was to take them to Fort de France for a military funeral.

On their arrival near the ruined city they found the volcano in so frightful a state of activity as to render their enterprise a very perilous one. A party was landed from the *Potomac*, but before the cruiser could anchor, there came several tremendous explosions. Immense quantities of lava poured from the crater, and clouds of dust darkened the sky. The *Indefatigable* at once put to sea.

With steam up the *Potomac* stood ready to run as soon as the rescue party could get out from shore and on board. To the general din it added its note of alarm. The party of rescuers ran along the beach and were taken off by a boat from the tug. They were barely in time. As the steamship got well under way, another flood of fire poured down from Pelee, and a broad stream of lava ran into the sea, while out of the sky rained a storm of rocks and ashes.

A DARING RESCUE PARTY

In spite of the threatening aspect of the volcano, it was determined later in the day to make another attempt to recover the bodies of Mr. Prentis and Mr. Japp. The searching party was divided into two squads. One, led by Ensign Miller, went to the site of the American Consulate, and soon had the body of Mr. Prentis encased in a metallic and hermetically sealed coffin. Six stalwart fellows shouldered the body and started with it for the landing.

In the meantime, another party, led by Lieutenant McCormick, of the *Potomac*, had proceeded to the British Consulate, about half a mile to the northward of the American Consulate,

Fortunately, this was within view of the crater of Mont Pelee. Lieutenant McCormick saw a column of smoke and fire belch from the volcano, down the side of which a stream of molten lava flowed. Directing his men to make all haste back to the *Potomac*, the Lieutenant turned aside to give warning to the party which was carrying away the body of the American Consul. "For God's sake, boys, get to the boat quick if you would save your lives!" he gasped. "The volcano has exploded, and destruction is upon us."

At that instant there was a deafening crash of thunder. It almost seemed as though scores of thunderbolts had been forced into one. As it died away the loud siren of the *Indefatigable*, which was in the roadstead, screamed a warning. The British cruiser almost immediately put out to sea at top speed. Without cessation the whistle of the *Potomac* was blowing. There was another rumble, and the sky was filled with lightning. Then Mont Pelee cast upward a vast column, a mile or more high. By a fortunate turn of the wind the lives of all in the party were saved. The ashes, gas, smoke, and stones, instead of pouring immediately upon them, were carried out over the sea.

BRAVERY OF THE SAILORS.

Working among the ruins were a few Frenchmen, who had remained ashore after their fellows had fled in fright. These men became panic-stricken and some of them were in hysterics. They fell upon their knees, and prayed to be saved from the destruction which they feared was about to fall upon them. Under the circumstances, the presence of mind and bravery of the American sailors was worthy of the greatest praise. They refused to put down their burden.

As rapidly as possible the sailors made their way over the debris to the shore. Once one of them stumbled. His fellows

waited until he could recover himself, when all went on together, still bearing the coffined body of the Consul. Half a mile was covered in this manner. Each minute the sky darkened. The heat was beyond comprehension. In the air was volcanic dust that made respiration hard labor.

Finally the distance was covered, and at the end it was discovered that, after all, the body would have to be temporarily abandoned. Heavy seas were sweeping shoreward. It was with great difficulty that the party was taken on board by the *Potomac*, but it was accomplished safely and just in time.

A MOST AWE-INSPIRING SIGHT

Straight out to sea for five miles ran the *Potomac*, while all eyes watched the eruption, the grandest and most awe-inspiring sight ever witnessed by man. There was an inner column of fire that reached perpendicularly into the air. About it was a funnel-shaped mass of ashes and gas, that could be penetrated by the eye only when the flames burned brightest.

Several new craters seemed to have been formed, and from them lava was flowing down to the ocean. As the molten mass reached the water great clouds of steam were raised, and the sinister hissing could be heard amid the roar of the eruption.

When the *Potomac* had been put beyond the apparent danger-zone an observation was taken. Then the ship was turned up the coast and was run in under the column of death. As close as she could be sent without courting destruction, the *Potomac* went back towards the stream of lava. All about her the sea was boiling, and the steam that came up over the sides was so dense as to make it all but impossible to see through it. Again, a turn was made seaward, but as it was seen that the wind had shifted the

danger from St. Pierre, she ran back to the landing. A party of sailors went ashore and brought off the body. The *Potomac* returned with it to Fort de France, where all were then in a panic.

Owing to the hasty retreat that was made from the British Consulate, which lay a mile back from the shore, the body of Mr. Japp, which had been encoffined, was not recovered.

BURIAL OF CONSUL PRENTIS

Never before was there such a burial as was given to the body of Thomas T. Prentis, the American Consul at St. Pierre. The body, recovered from the ruins (as we have seen) at the risk of the lives of the men who were sent ashore from the *Potomac*, was taken to the cemetery back of Fort de France. There were brief services at the grave, led by Captain McClean, of the *Cincinnati*. About the grave stood officers, marines and sailors from the *Cincinnati* and the *Potomac*. The gloom was made more intense by the knowledge held by each one present that his own life was in imminent danger.

An ominous salute was fired by the volcano that had brought destruction upon the Consul. While the service was being read, there was a succession of deep, sullen detonations that might have come from great guns belonging to a mighty fleet. As the grave was being filled a cloud of ashes came over the city, and a darkness as of night followed. The volcano had taken part in the services over the body of its victim.





A ST. PIERRE HOME



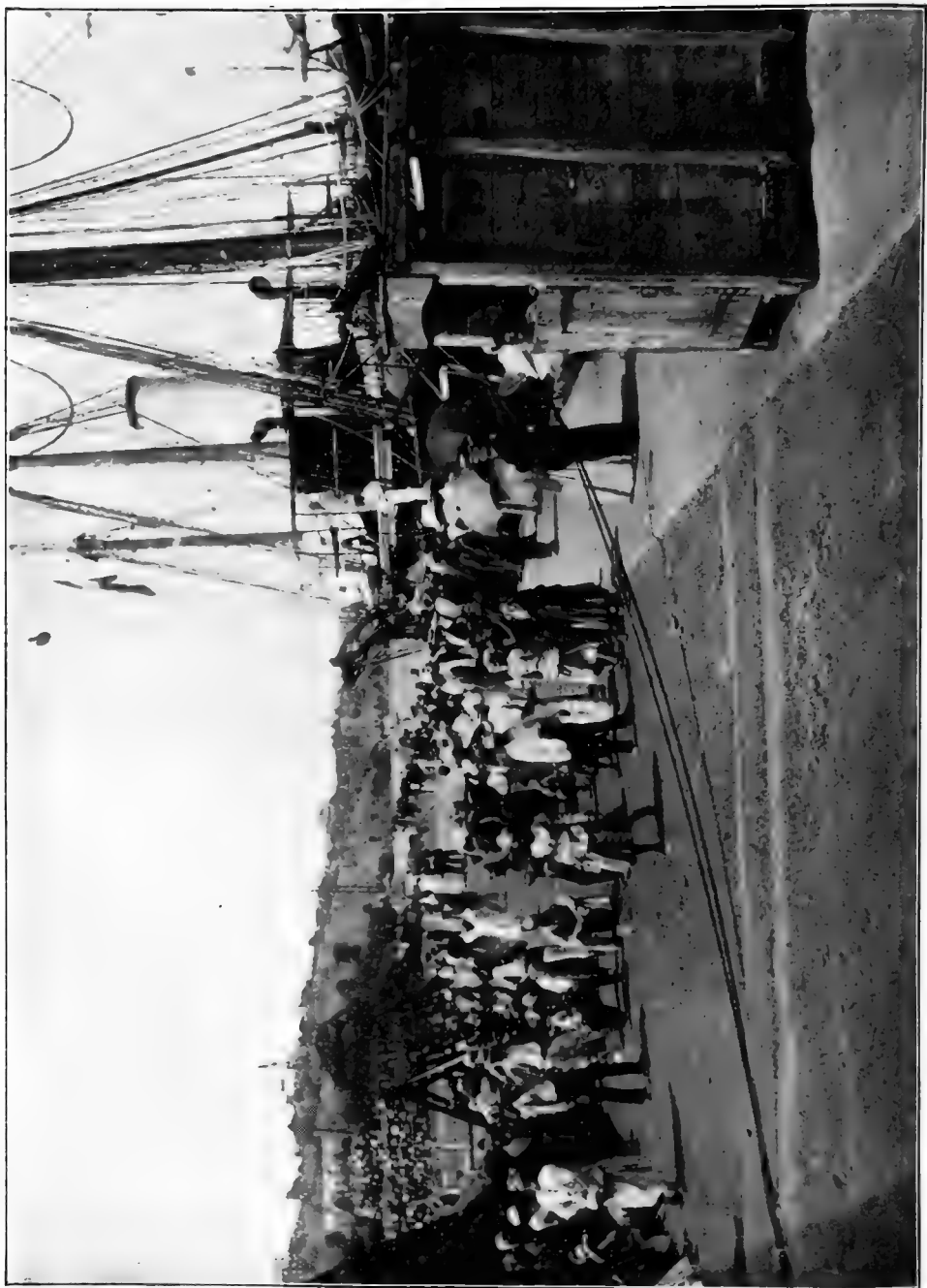
A PALM AVENUE LEADING UP TO RESIDENCE

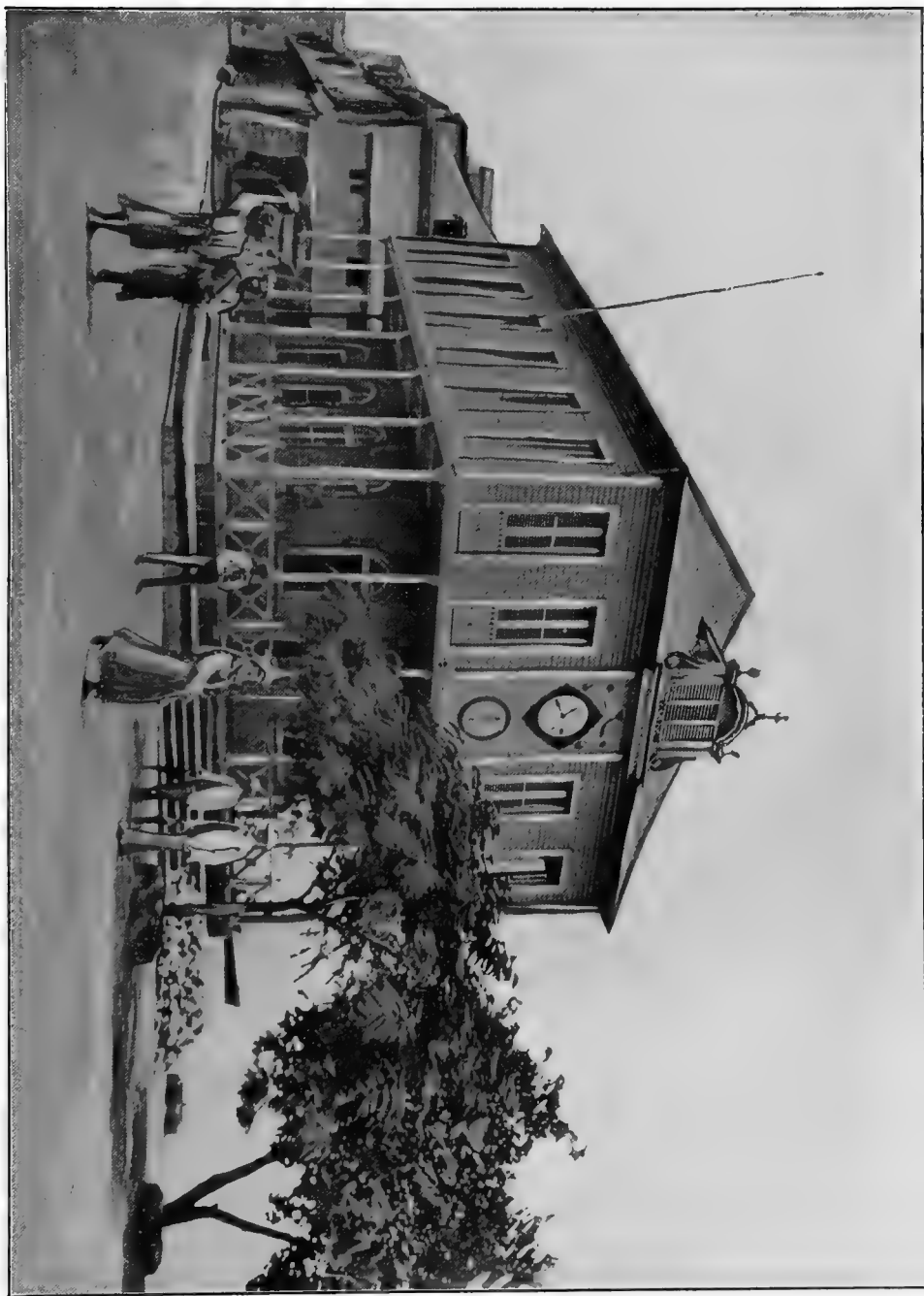


A STREET SCENE IN ST. PIERRE



Copyright, J. Murray Jordan. A BREAD-SELLER IN MARTINIQUE





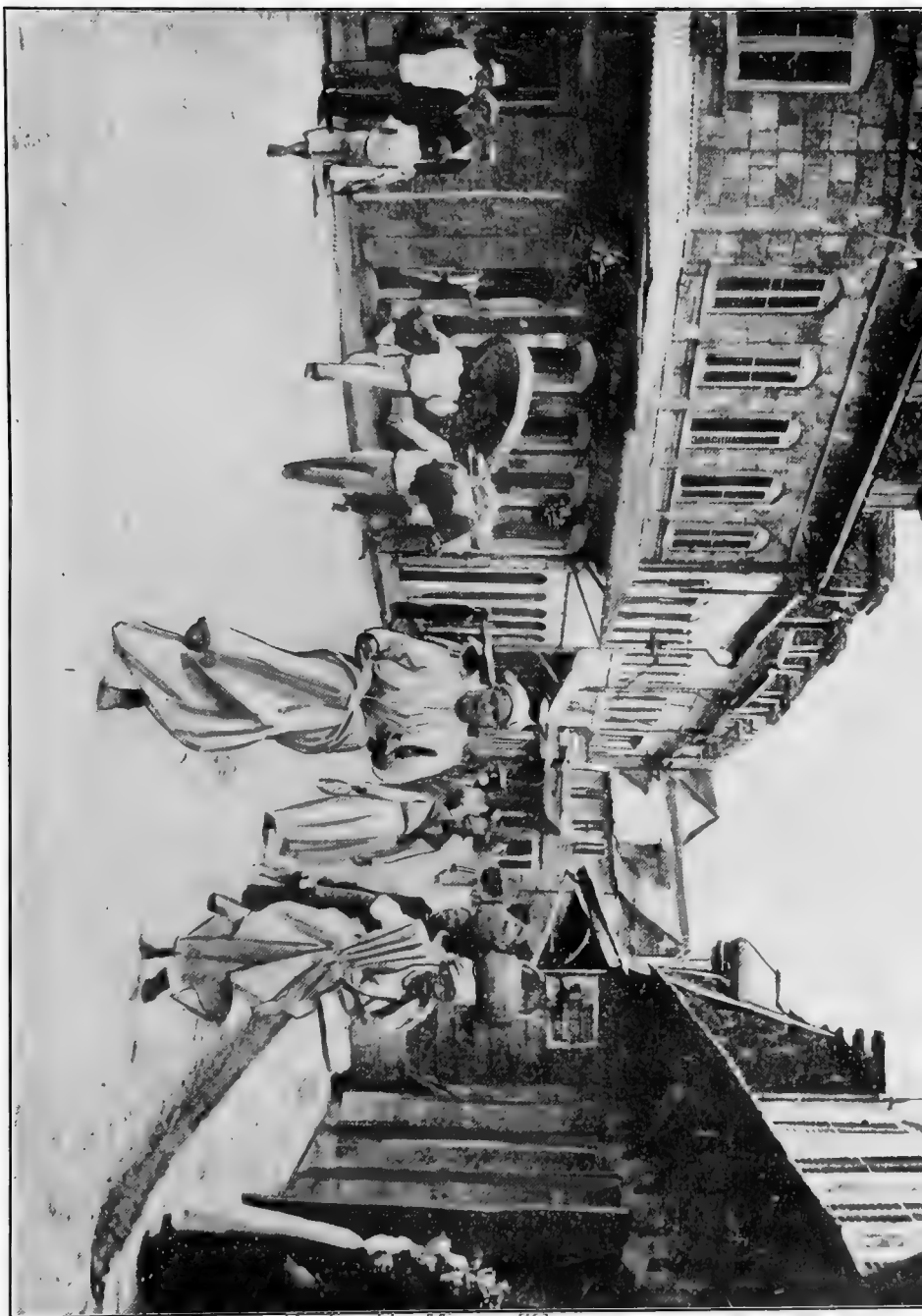
CHAMBER OF COMMERCE, ST. PIERRE



CRATER OF LA SOUFRIERE, ST. VINCENT

View of west side above the lake. Previous to the eruption of La Soufriere, St. Vincent, May 6, 1902, there was a lake of clear water at the bottom of the crater which had existed there since the eruption of 1612. The crater rim was about 2,500 feet above the sea.

A STREET IN ST. PIERRE





A STREET IN ST. PIERRE.

Showing a Few Dwellings, and the Hilly Nature of the Town.

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CHAPTER VI.

St. Vincent Island and Mont Soufriere in 1812.

AMONG all the islands of the Caribbees St. Vincent is unique in natural wonders and beauties. Situated about ninety-five miles west of Barbados, it has a length of eighteen and a width of eleven miles, the whole mass being largely composed of a single peak which rises from the ocean's bed. From north to south volcanic hills traverse its length, their ridges intersected by fertile and beautiful valleys.

A ridge of mountains crosses the island, dividing it into eastern and western parts. Kingstown, the capital, a town of 8,000 inhabitants, is on the southward side and extends along the shores of a beautiful bay, with mountains gradually rising behind it in the form of a vast amphitheatre. Three streets, broad and lined with good houses, run parallel to the water-front. There are many other intersecting highways, some of which lead back to the foothills, from which good roads ascend the mountains.

The majority of the houses have red tile roofing and a goodly number of them are of stone, one story high, with thick walls after the Spanish style—the same types of houses that were in St. Pierre and which are not unlike the old Roman houses which in all stages of ruin and semi-preservation are found in Pompeii to this day.

Behind the general group of the houses of the town loom the Governor's residence and the buildings of the botanical gardens which overlook the town.

Kingstown is the trading centre and the town of importance in the island. It contains the churches and chapels of five Protestant denominations and a number of excellent schools. Away from Kingstown, and the smaller settlement of Georgetown, the population is almost wholly rural, occupying scattered villages which consist of negro huts clustering around a few substantial buildings or of cabins grouped about old plantation buildings somewhat after the ante-bellum fashion in our own Southern States.

One of the tragedies of the West Indies was the sinking of old Port Royal, the resort of buccaneers, in 1692. The harbor of Kingstown is commonly supposed to cover the site of the old settlement. There is a tradition that a buoy for many years was attached to the spire of a sunken church in order to warn mariners. Three thousand persons perished in the disaster.

DESCENDANTS OF ORIGINAL INDIAN POPULATION

The northern portion of the island, that desolated by the recent volcanic eruption, was inhabited by people living in the manner just described, the great majority of them being negroes. The total population of the island is about 45,000, of whom 30,000 are Africans and about 3,000 Europeans, the remainder being nearly all Asiatics. There are, or rather were, a number of Caribs, the descendants of the original warlike Indian population of these islands. Many of these live in St. Vincent, though there are others in Dominico. As their residence was in the northern section of the island, the volcano seems to have completed the work for the Caribs of this island which the Spaniard long ago began. These Caribs were really half-breds, having amalgamated with the negroes. Many of the blacks own land of their own, raising arrow root, which, since the decay of the sugar industry, is the chief export.

In an island only eighteen miles long by eleven broad there is not room for any distinctly marked mountain range. The whole of St. Vincent, in fact, is a fantastic tumble of hills, culminating in the volcanic ridge which runs lengthwise of the oval-shaped island. The culminating peak of the great volcanic mass, for St. Vincent is nothing more, is Mont Garou, of which La Soufriere is a sort of lofty excrescence in the northwest, 4,048 feet high, and flanking the main peak at some distance away.

It may be said that all the volcanic mountains in this part of the West Indies have what the people call a "soufriere"—a "sulphur pit," or "sulphur crater"—the name coming, as in the case of past disturbances of Mont Pelee, from the strong stench of sulphuretted hydrogen which issues from them when the volcano becomes agitated.

In 1812 it was La Soufriere adjacent to Mont Garou which broke loose on the island of St. Vincent, and it is the same Soufriere which again has devastated the island and has bombarded Kingstown with rocks, lava and ashes.

The old crater of Mont Garou has long been extinct, and, like the old crater of Mont Pelee, near St. Pierre, it had far down in its depths, surrounded by sheer cliffs from 500 to 800 feet high, a lake. Glimpses of the lake of Mont Garou are difficult to get, owing to the thick verdure growing about the dangerous edges of the precipices, but those who have seen it describe it as a beautiful sheet of deep blue water.

THE APPEARANCE OF THE SOUFRIERE

Previous to the eruption of 1812 the appearance of the Soufriere was most interesting. The crater was half a mile in diameter and five hundred feet in depth. In its centre was a

conical hill, fringed with shrubs and vines ; at whose base were two small lakes, one sulphurous, the other pure and tasteless. This lovely and beautiful spot was rendered more interesting by the singularly melodious notes of a bird, an inhabitant of these upper solitudes, and altogether unknown to the other parts of the island—hence called, or supposed to be, “invisible,” as it had never been seen. (It is of interest to state that Frederick A. Ober, in a visit to the island some twenty years ago, succeeded in obtaining specimens of this previously unknown bird.) From the fissures of the cone a thin white smoke exuded, occasionally tinged with a light blue flame. Evergreens, flowers and aromatic shrubs clothed the steep sides of the crater, which made, as the first indication of the eruption on April 27, 1812, a tremulous noise in the air. A severe concussion of the earth followed, and then a column of thick black smoke burst from the crater.

THE ERUPTION OF 1812

The eruption which followed these premonitory symptoms was one of the most terrific which had occurred in the West Indies up to that time. It was the culminating event which seemed to relieve a pressure within the earth's crust which extended from the Mississippi Valley to Caracas, Venezuela, producing terrible effects in the latter place. Here, thirty-five days before the volcanic explosion, the ground was rent and shaken by a frightful earthquake which hurled the city in ruins to the ground and killed ten thousand of its inhabitants in a moment of time.

La Soufriere made the first historic display of its hidden powers in 1718, when lava poured from its crater. A far more violent demonstration of its destructive forces was that above mentioned. On his occasion the eruption lasted for three days, ruining a number of

the estates in the vicinity and destroying many lives. Myriads of tons of ashes, cinders, pumice and scoriæ, hurled from the crater, fell in every section of the island. Volumes of sand darkened the air, and woods, ridges and cane fields were covered with light gray ashes, which speedily destroyed all vegetation. The sun for three days seemed to be in a total eclipse, the sea was discolored and the ground bore a wintry appearance from the white crust of fallen ashes.

Carib natives who lived at Morne Rond fled from their houses to Kingstown. As the third day drew to a close flames sprang pyramidically from the crater, accompanied by loud thunder and electric flashes, which rent the column of smoke hanging over the volcano. Eruptive matter pouring from the northwest side plunged over the cliff, carrying down rocks and woods in its course. The island was shaken by an earthquake and bombarded with showers of cinders and stones, which set houses on fire and killed many of the natives.

THE TERRIBLE EARTHQUAKE AT CARACAS

For nearly two years before this explosion earthquakes had been common, and sea and land had been agitated from the valley of the Mississippi to the coasts of Venezuela and the mountains of New Grenada, and from the Azores to the West Indies. On March 26, 1812, these culminated in the terrible tragedy, spoken of above, of which Humboldt gives us a vivid account.

On that day the people of the Venezuelan city of Caracas were assembled in the churches, beneath a still and blazing sky, when the earth suddenly heaved and shook, like a great monster waking from slumber, and in a single minute 10,000 people were buried beneath the walls of churches and houses, which tumbled in hideous ruin upon their heads. The same earthquake made itself

felt along the whole line of the Northern Cordilleras, working terrible destruction, and shook the earth as far as Santa Fé de Bogota and Honda, 180 leagues from Caracas. This was a preliminary symptom of the internal disorder of the earth.

While the wretched inhabitants of Caracas who had escaped the earthquake were dying of fever and starvation, and seeking among villages and farms places of safety from the renewed earthquake shocks, the almost forgotten volcano of St. Vincent was muttering in suppressed wrath. For twelve months it had given warning, by frequent shocks of the earth, that it was making ready to play its part in the great subterranean battle. On the 27th of April its deep-hidden powers broke their bonds, and the conflict between rock and fire began.

THE MOUNTAIN STONES A HERD-BOY

The first intimation of the outbreak was rather amusing than alarming. A negro boy was herding cattle on the mountain side. A stone fell near him. Another followed. He fancied that some other boys were pelting him from the cliff above, and began throwing stones upward at his fancied concealed tormentors. But the stones fell thicker, among them some too large to be thrown by any human hand. Only then did the little fellow awake to the fact that it was not a boy like himself, but the mighty mountain, that was flinging these stones at him. He looked up and saw that the black column which was rising from the crater's mouth was no longer harmless vapor, but dust, ashes and stones. Leaving the cattle to their fate, he fled for his life, while the mighty cannon of the Titans roared behind him as he ran. For three days and nights this continued; then, on the 30th, a stream of lava poured over the crater's rim and rushed downward, reaching the sea in four hours, and the great eruption was at an end.

On the same day, says Humboldt, at a distance of more than 200 leagues, "the inhabitants not only of Caracas, but of Calabozo, situated in the midst of the Lianos, over a space of 4,000 square leagues, were terrified by a subterranean noise which resembled frequent discharges of the heaviest cannon. It was accompanied by no shock, and, what is very remarkable, was as loud on the coast as at eighty leagues' distance inland, and at Caracas, as well as at Calabozo, preparations were made to put the place in defence against an enemy who seemed to be advancing with heavy artillery."

It was no enemy that man could deal with. Fortunately, it confined its assault to deep noises, and desisted from earthquake shocks. Similar noises were heard in Martinique and Guadeloupe, and here also without shocks. The internal thunder was the signal of what was taking place on St. Vincent. With this last warning sound the trouble, which had lasted so long, was at an end. The earthquakes which for two years had shaken a sheet of the earth's surface larger than half Europe, were stilled by the eruption of St. Vincent's volcanic peak.

BARBADOS COVERED WITH ASHES

Northeast of the original crater of the Soufriere a new one was formed which was a half mile in diameter and five hundred feet deep. The old crater was in time transformed into a beautiful blue lake, as above stated, walled in by ragged cliffs to a height of eight hundred feet.

It was looked upon as a remarkable circumstance that although the air was perfectly calm during the eruption, Barbados, which is ninety-five miles to the windward, was covered inches deep with ashes. The inhabitants there and on other neighboring islands were

terrified by the darkness, which continued for four hours and a half. Troops were called under arms, the supposition from the continued noise being that hostile fleets were in an engagement.

The movement of the ashes to windward, as just stated, was viewed as a remarkable phenomenon, and is cited by Elise Reclus, in "The Ocean," to show the force of different aerial currents; "On the first day of May, 1812, when the northeast trade-wind was in all its force, enormous quantities of ashes obscured the atmosphere above the Island of Barbados, and covered the ground with a thick layer. One would have supposed that they came from the volcanoes of the Azores, which were to the northeast; nevertheless they were cast up by the crater in St. Vincent, one hundred miles to the west. It is therefore certain that the debris had been hurled, by the force of the eruption, above the moving sheet of the trade-winds into an aerial river proceeding in a contrary direction." For this it must have been hurled miles high into the air, till caught by the current of the anti-trade winds.

KINGSLEY'S VISIT TO SAINT VINCENT

From Charles Kingsley's "At Last" we extract, from the account of the visit of the author to St. Vincent, some interesting matter concerning the 1812 eruption and its effect on the mountain; also its influence upon distant Barbados, as just stated.

"The strangest fact about this eruption was, that the mountain did not make use of its old crater. The original vent must have become so jammed and consolidated, in the few years between 1785 and 1812, that it could not be reopened, even by a steam force the vastness of which may be guessed at from the vastness of the area which it had shaken for two years. So, when the eruption was over, it was found that the old crater-lake, incredible as it may

seem, remained undisturbed, so far as has been ascertained ; but close to it, and separated only by a knife-edge of rock some 700 feet in height, and so narrow that, as I was assured by one who had seen it, it is dangerous to crawl along it, a second crater, nearly as large as the first, had been blasted out, the bottom of which, in like manner, was afterward filled with water.

“I regretted much that I could not visit it. Three points I longed to ascertain carefully—the relative heights of the water in the two craters ; the height and nature of the spot where the lava stream issued ; and, lastly, if possible, the actual causes of the locally famous Rabacca, or ‘Dry River,’ one of the largest streams in the island, which was swallowed up during the eruption, at a short distance from its source, leaving its bed an arid gully to this day. But it could not be, and I owe what little I know of the summit of the soufriere principally to a most intelligent and gentleman-

The darkness was still intense, and grew more intense as the morning wore on. A slow and silent rain of impalpable dust was falling over the whole island. The negroes rushed shrieking into the streets. Surely the last day was come. The white folk caught (and little blame to them) the panic, and some began to pray who had not prayed for years. The pious and the educated (and there were plenty of both in Barbados) were not proof against the infection. Old letters describe the scene in the churches that morning as hideous—prayers, sobs, and cries, in Stygian darkness, from trembling crowds. And still the darkness continued and the dust fell.

INCIDENTS AT BARBADOS

“I have a letter written by one long since dead, who had at least powers of description of no common order, telling how, when he tried to go out of his house upon the east coast, he could not find the trees on his own lawn save by feeling for their stems. He stood amazed not only in utter darkness, but in utter silence; for the trade-wind had fallen dead, the everlasting roar of the surf was gone, and the only noise was the crashing of branches, snapped by the weight of the clammy dust. He went in again, and waited. About one o’clock the veil began to lift; a lurid sunlight stared in from the horizon, but all was black overhead. Gradually the dust drifted away; the island saw the sun once more, and saw itself inches deep in black, and in this case fertilizing, dust. The trade-wind blew suddenly once more out of the clear east, and the surf roared again along the shore.

“Meanwhile a heavy earthquake-wave had struck part at least of the shores of Barbados. The gentleman on the east coast, going out, found traces of the sea, and boats and logs washed up some

ten to twenty feet above high-tide mark; a convulsion which seemed to have gone unmarked during the general dismay.

“One man at least, an old friend of John Hunter, Sir Joseph Banks and others their compeers, was above the dismay, and the superstitious panic which accompanied it. Finding it still dark when he rose to dress, he opened (so the story used to run) his window; found it stick, and felt upon the sill a coat of soft powder. ‘The volcano in St. Vincent has broken out at last,’ said the wise man, ‘and this is the dust of it.’ So he quieted his household and his negroes, lighted his candles, and went to his scientific books, in that delight, mingled with an awe not the less deep, because it is rational and self-possessed, with which he, like the other men of science, looked at the wonders of this wondrous world.”

CHAPTER VII.

The Desolation of St. Vincent.

WHILE the great catastrophe which occurred on the Island of Martinique will be known from the name and horrors of St. Pierre or Mt. Pelee, yet the Island of St. Vincent also passed through a veritable baptism of fire, and the results were only less terrible than those that followed the eruption of Mont Pelee, destroying the town of St. Pierre and its environs with their 30,000 inhabitants.

Mont Soufriere broke into activity simultaneously with Mont Pelee and many of the people were destroyed. A line drawn from Chateau Belaire to Georgetown would divide the Island of St. Vincent into halves. Few human beings remained alive north of it. Many bodies were recovered, and it is known that many hundreds lay buried under the ashes that fell over the whole island.

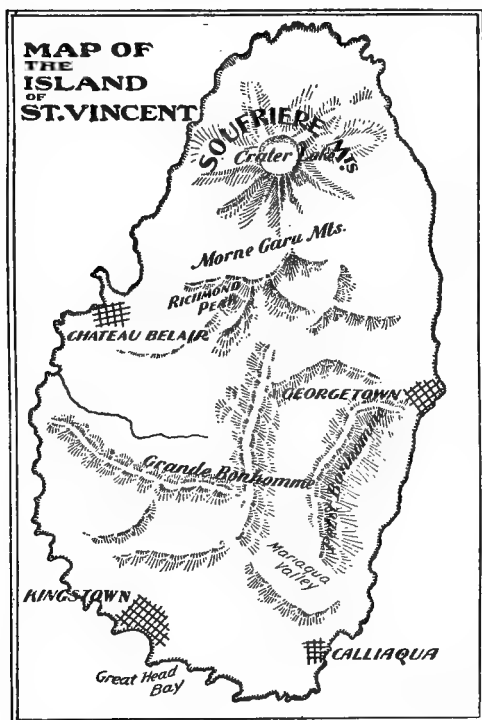
It is estimated that nearly 2000 were sacrificed by the eruption. This includes most of the Carib Indians, which means the practical extinction of the race that was found on the island by Columbus four centuries ago. An old Indian prophecy that the Caribs would be sacrificed to the fire god, which they worshipped, has thus been fulfilled. Of the Caribs a small number remain on the Islands of St. Lucia and Dominica.

From St. Lucia the eruption of Mont Soufriere was visible during the night of May 7. The following night the steamship *Wear*, of the Royal Mail service, attempting to force her way to

Kingstown, ran into a floating bank of ashes. For three hours the ship was practically helpless in a cloud of smoke and sulphurous gas denser than that which floated down from Mont Pelee.

When Kingstown was finally reached at daybreak, it was found panic stricken. The streets were covered two inches deep with ashes and stones that had fallen during the night. Kingstown is

fifteen miles from the crater which ejected the stones, yet the rain of missiles was almost incessant for three days. From Chateau Belaire word came that the distress there was great. A call had been sent for a clergyman, and one was taken up by the *Wear*. Down the sides of Mont Soufriere were flowing hundreds of streams of lava, which, uniting and separating, formed a network from which there was no possible escape for any living thing caught within its grasp.



THE LAVA STREAMS

By the explosion of 1812 a river that had existed ever since the discovery of the island was dried up. Down its channel for days after the eruption there flowed a swift stream of molten lava, which glistened like liquid silver, and which flowed into the sea within 100 yards of Georgetown. As the water and the lava met, a great cloud of steam arose, and the hissing could be heard for miles.

From a distance dozens of craters could be seen, now opening and again closing, near the crest of Mont Soufriere. The force of the eruption seemed to be lessened, but the danger continued still great. Many searching parties were immediately sent out. Seven estates were found to be ruined beyond hope of repair. Two chapels were buried under a stream of lava. Many houses were covered under masses of ashes and lava, and there was hardly a spot in the island that was not under from two inches to ten feet of ashes.

The British steamer *Cennet* on Sunday ran through five miles of smoke that was so dense that the crew were almost suffocated. For more than an hour the ship had to be left to its own guidance. Mont Soufriere, though not so active as it was immediately after the first eruption, was still so threatening as to terrify the inhabitants. Smoke and flames continued to belch from the crater, over which there was an incessant play of lightning, forking out from the column, that reached so far up into the sky that the eye could not perceive its crest.

It was more than two weeks previous to May 10, that Mont Soufriere first gave warning that it was about to give a display of fire-works as majestic as had been seen by man during the last thousand years. Mont Soufriere can be seen fully fifty miles at sea on a clear day. For ninety years the old volcano had been somnolent. On rare occasions it had grumbled internally, but it had been regarded as harmless by the Indians, who told of the eruptions which ceased long ago, and which they had carried in their traditions. After the eruption of 1812 the old crater closed, and water, filling it, formed a beautiful blue lake.

For many days preceeding the eruption Soufriere labored inwardly in a manner such as was new to the present generation.

Then, on May 5, the crater lake became greatly disturbed. It began to boil and bubble like a great cauldron. Steam arose from it in immense clouds. The rumbling beneath the mountain redoubled in force, and at 2 o'clock that afternoon Soufriere trembled as though it was in the throes of a terrible agony. Then came a series of severe earthquakes that shook the entire island.

DESCRIPTION OF THE OUTBREAK OF MAY 7, 1902.

That night sulphuric flames played about the summit of the volcano, giving it a weird and terrible appearance. Steam continued to rise in clouds, and the thunders of the skies were joined with those that came from the bowels of the Soufriere. All during Wednesday the splendid phenomenon continued, giving those who lived in the near vicinity of the volcano ample time to make their escape. All seem to have been hypnotized, and of the numbers who were there only a few hundred went away.

It was noon on Wednesday, May 7, 1902, that Mont Soufriere suddenly opened, sending six separate streams of lava pouring and boiling down its sides. Death was everywhere, and in its most terrible forms. Lightning came from the sky, killing many who had escaped the molten streams that poured into the valleys.

For this great tragedy the settings were wonderful. Soufriere literally rocked in its agony. From its summit a majestic column of smoke, inky black, reached skyward. The craters were vomiting incandescent matter that gave forth prismatic lights as it rolled away toward the sea. Great waves of fire seemed to hedge about the mountain top. Such thunder as has seldom been heard by man cracked and rolled through the heavens. From the earth came tremendous detonations. These joined with the thunder, all merging in an incessant roar that added to the panic of fleeing inhabitants.

This lasted through the night, and the day and night following. On Thursday morning a huge column, so black that it had the appearance of ebony, arose to an estimated height of eight miles from the top of the volcano.

Ashes and rock, as well as lava, were carried skyward in this column to deluge the island and the ocean for miles around. Gradually the column mushroomed at the top and spread out into dense clouds, that descended to bring night at noontime. The atmosphere was so laden with sulphurous gas that life was made almost impossible. Hundreds of those nearest to Soufriere were suffocated by this gas before they were touched by the burning lava.

A TERRIBLE NIGHT

Many expected that the entire island would be destroyed, and the night of Thursday was given up to prayers. All that night the darkness was beyond description, save when everything was made light as broad day by the lightning which forked out from the volcano. The earth quaked incessantly, the mountains shook, stones, lava and great quantities of ashes never ceased to fall. So terrible were the thunders that it seemed to the terrified that the universe was being rent to pieces and that the last day had come.

Friday brought a slight respite. Soufriere became less agitated. The lava streams did not decrease, but the showers of rocks stopped for a time. Then those of stout heart ventured out to take stock of the wonderful ruin that had been wrought.

All areas of cultivation were found to be destroyed, buried under banks of volcanic matter. Wallibou and Richmond plantations and villages on the leeward coast were wrecked. Wallibou was partly under water, which had been swept in from the sea by a

tidal wave. Five other plantations were gone and every vestige of human life had vanished.

The Carib Indians had made that portion of the island lying at the base of Soufriere their country. That entire district was a smoking, incinerated ruin. Ashes were everywhere, being in no place less than two feet deep, and in some places lava had rolled over the deep banks of ashes. Every Indian seemed to have disappeared, there being no survivors known until some time afterward. All vegetation was destroyed. Not a sprig of green was to be seen on the island. Live stock had died. Houses had vanished from their sites. Rivers were dry and their beds ran lava.

ON EVERY HAND COMPLETE DESOLATION

Everywhere north of Chateau Belaire were dead bodies, some half buried, others showing that they had been stricken down by the lightning. A few seemed to have been dipped in lava, which took form from them. Decomposition seemed to be almost immediate. The dead were buried or burned as rapidly as possible, but the conditions were such that pestilence could hardly be averted.

Kingstown was safe, but Georgetown suffered terribly. In the hospitals there hundreds of sufferers were being cared for, with little chance that any of them would recover. There followed a peril of famine. Had not supplies been quickly received, hundreds would have starved. When the violent eruption had ceased, the air was filled with volcanic dust and ashes, creating an intense thirst and such suffering as can hardly be imagined by those not on the island.

The steamer *Wear*, sent by government officials from St. Lucia on the evening of the 8th, to visit the island, reported that terrible flames were visible during the entire journey. At midnight it was seen that a volcano was in eruption, about four miles away.

The *Wear* ran into heavy showers of gray ashes, and the people on board were almost suffocated. The atmosphere was so dense that nothing could be seen. The steamer put about and steamed to the south for two hours before she was clear of the showers of ashes. At three o'clock in the morning she put back toward the island and encountered more ashes and was again compelled to put off. She arrived at Kingstown at about five o'clock on the morning of the 9th.

It was then seen that the volcano was in constant eruption, and there was a tremendous roar. Forked lightning played incessantly over the disturbed section, the flashes averaging from sixty to one hundred a minute. Kingstown, which is twelve miles from the volcano, had been covered with three inches of ashes and showers of stones on Thursday, and the glow from the eruption was visible forty miles away.

The terrific force of the eruption may be illustrated by one incident. Ashes in great quantity fell on the deck of the British steamship *Coya*, Captain Eton, when she was 250 miles distant from the island.

RIVERS OF LAVA.

When the *Wear* was opposite Belaire there was a grand view of the west side of the crater. Rivers of lava were coming down the mountain sides in every direction and flowing into the sea. The huge crater was covered with smoke, and there was an incessant eruption. Great quantities of ashes were blown into the air and were falling toward the sea. A new lane was observed running out toward the sea for half a mile. It was of a brownish color, and was probably lava which had been cooled by the sea water. It was impossible to get close to the town.

The sea was littered with trees and other wreckage. An attempt was made to proceed to St. Lucia through the falling ashes, but it was found impossible. It meant suffocation to try it. A run outward was made, but the vessel entered the belt miles out at sea, with the same result. On the horizon there was nothing to be seen but falling ashes and other material, which was piled up like an enormous wall. Inside the belt all was dark.

Putting back, the *Wear* steamed around the island to the windward. Opposite Georgetown she encountered a gale of wind carrying smoke and debris. To the north the entire territory of the disturbed district was clearly visible. Besides the large crater, numerous small craters were in eruption, and many streams of lava were flowing seaward, one of them half a mile wide.

On the 13th it was reported from Castries, St. Lucia, that the volcano was still in destructive eruption. A terrific cannonade seemed to be going on a hundred miles away. The reports were followed by columns of smoke, rising miles in the air. Immense balls of colored fire also issued from the crater. Lightning played fiercely in the upper sky, and the whole northern part of the island was one mass of spreading flame. It was impossible to reach the burning district by land or sea, and there were no means of estimating the destruction wrought to life and property. Kingstown was safe, though showers of ashes and pebbles continually fell on the town. The volcano itself was invisible.

EFFECTS OF THE ERUPTION

No person at that time was able to approach within eight miles of the new crater of the Soufriere volcano, but, judging from what could be seen from a considerable distance, the old lake at the summit of the mountain had disappeared. The numerous fissures

in the mountain side continued to throw out vapor, and the subterranean murmurings and tremblings indicated continued unrest. During the afternoon of Monday a dense volume of steam and smoke rose from the volcano and the whole island was covered by a peculiar mist, while the inhalation of noxious vapors made breathing very difficult and added to the distress of the people.

Physical changes resulted from the eruptions, including several fissures on La Soufriere and an inlet of the sea where the estate of Walibou had been. Richmond, an estate adjacent to Walibou, which was formerly flat, and upon which there were several laborers' cottages, had been completely burned, and out of the estate there had arisen a large ridge of ground. A ravine a hundred feet deep, the source of the Rabacca or Dry River, was filled level with lava. This river bed had been dry since the eruption of 1812, and will perhaps be dry forever.

The estimate of deaths had gradually grown from a few hundred to 1600 by the 12th, this being the estimate sent to Secretary Hay by our special correspondent on the island of Barbados, General A. S. MacAllister, United States Consul at that island. The following is the text of his cable message :—"Sixteen hundred deaths at St. Vincent ; four thousand destitute. Immediate wants supplied. Aid needed for six months. This authentic."

As the days went by still more dead bodies were discovered. Of these 400 remained unburied. But that was the least of the trouble. Thus far no effort had been made to do more than care for the living and bury the dead. All about were dead cattle, polluting the atmosphere, which already was heavily laden with disease. In one of the ravines near Morne Garou the bodies of eighty-seven Carib Indians were found heaped together. Not far away were the carcasses of hundreds of cattle.

It was later ordered that these menaces to life should be removed, quicklime being used to destroy the bodies. Fires were kindled over the district which was laid waste by Soufriere, and in these were thrust the carcasses of the dead cattle.

A CORRESPONDENT'S STATEMENT

On May 15 a press correspondent returned from a visit, on horseback, to the devastated district of the island, through which he made a journey of fifty miles, and penetrated to within five miles of the crater. The following was the result of his observations:—

“The entire northern part of the island is covered with ashes to an average depth of eighteen inches, varying from a thin layer at Kingstown to two feet or more at Georgetown. The crops are ruined, nothing green can be seen, the streets of Georgetown are cumbered with snowdrift-like heaps of ashes, and ashes rest so heavily on the roofs that in several cases they have caused them to fall in. There will soon be 5,000 destitute persons in need of assistance from the government, which is already doing everything possible to relieve the sufferers. There are a hundred injured people in the hospital at Georgetown, gangs of men are searching for the dead or rapidly burying them in trenches, and all that can be done under the circumstances is being accomplished.

“The arrival here of the first detachment of the Ambulance Corps, which brought sufferers from Georgetown, caused a sensation. This batch consisted of a hundred persons, whose charred bodies exhaled fetid odors, and whose loathsome faces made even the hospital attendants shudder. All these burned persons were suffering fearfully from thirst and uttering, when strong enough to do so, agonizing cries for water. It is doubtful whether any of the whole party will recover.

“While the outbreak of the volcano on the island of Martinique killed more people outright, more territory has been ruined in St. Vincent, hence there is greater destitution here. The injured persons were horribly burned by the hot grit, which was driven along with tremendous velocity. Twenty-six persons who sought refuge in a room ten feet by twelve were all killed. One person was brained by a huge stone nine miles from the crater.

BURIAL AND CARE OF VICTIMS

“Rough coffins are being made to receive the bodies of the victims. The hospital here is filled with dying people. Fifty injured persons are lying on the floor of that building, as there are no beds for their accommodation, though cots are being rapidly constructed of boards. This and similar work has been going on since immediately after the disaster, but two days elapsed before there were any burials, as the negroes refused to dig the necessary trenches, though they were offered three times their usual wages by the local authorities. The nurses employed are incompetent, but they are willing to learn, and are working hard. The negroes are indifferent to all that has taken place. They expect to receive government rations. There have been instances where they have refused to bury their own relatives.

“Since midnight on Tuesday the subterranean detonations here have ceased, and the Soufriere on Wednesday relapsed, apparently, into perfect repose, no smoke rising from the crater, and the fissures emitting no vapor. The stunted vegetation that formerly adorned the slopes of the mountain has disappeared, having given place to gray-colored lava, which greets the eye on every side. The atmosphere is dry. Rain would be welcome, as there is a great deal of dust in the air, which is disagreeable and irritating

to the throats and eyes, and is causing the merchants to put all their drygoods under cover. The white inhabitants are anxious to know whether the repose of the volcano is permanent, or whether it is the lull which usually precedes greater activity. Some people, anticipating that there is danger of further volcanic eruptions, are leaving the outlying towns for this city. The negroes who have remained on the estates are half-starved, and the few Carib survivors are leaving their caves and pillaging abandoned dwelling houses and shops. A number of arrests have been made in this connection.

ASPECT OF THE VOLCANO

“The report that the volcanic lake which occupied the top of the mountain has disappeared appears to be confirmed. A sea of lava, emitting sulphurous fumes, now apparently occupies the place, and several new craters have been formed. The last time the volcano showed activity, on Tuesday last, the craters, old and new, and numerous fissures in the mountain sides discharged hot vapor, deep subterranean murmurings were heard, the ground trembled at times, from the centre of the volcano huge volumes of steam rose like gigantic pine trees toward the sky, and a dense black smoke, mingling with the steam, issued from a new and active crater, forming an immense pall over the northern hills, lowering into the valleys and then rising and spreading until it enveloped the whole island in a peculiar gray mist. Simultaneous action upon the part of the volcanoes of Martinique and St. Vincent seems to denote a volcanic connection between these islands, and appears to verify the assumption of the volcanic origin of the mountain chains running parallel with the Soufriere in the Windward districts.

“The sulphurous vapors, which still exhale all over the island, are increasing the sickness and mortality among the surviving

inhabitants, and are causing suffering among the new arrivals. The hospital staffs are giving way to overwork, and are with difficulty bearing up, but the news of the dispatch of an ambulance corps from the garrison at Barbados and the statements made that further medical assistance will arrive here shortly are having a beneficial effect upon all concerned.

"The stench in the afflicted districts is terrible beyond description. Nearly all the huts left standing are filled with dead bodies. In some cases disinfectants and the usual means of disposing of the dead are useless, and cremation has been resorted to. When it is possible the bodies are dragged with ropes to the trenches and are there hastily covered up, quicklime being used when available. Many of the dead bodies were so covered with dust that they were not discovered until walked upon by visitors, or by the relieving officers or their assistants. The scenes witnessed were unprecedented in the history of this colony.

"Much importance is attached locally to the loss which the colony has sustained in the injury to the peasant proprietary, a scheme for whose development was lately started by the imperial government, with a view to assist the inhabitants and in order to encourage the people to attain prosperity."

A LATER STATEMENT

A later statement from Kingstown gave additional information, as follows:

"Were it possible to obtain transportation this island would be depopulated in a day. Such is the fear of further outbreak of La Soufriere. The volcano has ceased to be active, but there is general dread that it will break forth in mightier eruption.

"La Soufriere seems to have changed its shape. Its conical top has disappeared, and from a distance the mountain looks as though a

thumb had been pressed upon it, crushing down its apex. Where a pretty blue lake of great depth existed a fortnight ago there is now a bubbling cauldron of molten lava. Above this clouds of smoke and steam constantly rise. Over the island spreads a peculiar mist, injurious to the eyes and containing noxious properties that cause much distress.

"Some of the huts built by the Carib Indians still stand, and in every one there are bodies. Scattered about in the open there are hundreds of bodies, blistering in the terrible heat. The result is that a noxious exhalation spreads over the island of St. Vincent that is nauseating and which threatens a pestilence. This, in addition to the scarcity of food and water, makes the situation serious."

On the night of May 18 the alarm of the people of St. Vincent was renewed. The volcano, which had been temporarily still, resumed its activity. Throughout Sunday the adjoining districts trembled, and some of the shocks were felt at Kingstown. Smoke issued from the craters and fissures of the mountain, and the atmosphere throughout the island of St. Vincent was exceedingly hot. While the worshippers were returning from church at 8.30 P. M., an alarming luminous cloud suddenly ascended many miles high in the north of the island, and drifted sluggishly to the northeast. Incessant lightning fell on the mountain, and one severe flash seemed to strike about three miles from Kingstown. The thunderous rumblings in the craters lasted for two hours and then diminished until they became mere murmurings. During the remainder of the night the volcano was quiet, though ashes fell from 10 o'clock until midnight. The inhabitants were frenzied with fear at the time of the outbreak, dreading a repetition of the catastrophe which had caused such terrible loss of life on the island. They ran from the streets into the open country, crying and praying for preservation from another calamity. No one on the Island of St. Vincent slept that night.

Reports received from the districts in the vicinity of the volcano said that the rumblings of the craters were appalling, and that streams of lava flowed down the mountain side. The villagers who had fled to Chateau Belaire and Georgetown for safety poured into Kingstown, this being the furthest town from Soufriere. The royal mail steamer *Wear* brought refugees there from Chateau Belaire. Kingstown became congested, and the demands on the Government increased rapidly as more and more people were obliged to leave their homes and business.

REIGN OF TERROR AT KINGSTOWN.

The continuous agitation of the volcano and the absence of rain caused the vicinity of the afflicted villages to look like portions of the Desert of Sahara. A thick, smoky cloud overspread the island, all business was suspended, the streets were empty and everyone was terror stricken. The feeling of suspense grew painful. People passed their time gazing at the northern sky, where the thunder clouds gathered and the mournful roaring of the volcano was heard. Ashes and pumice fell slowly in the out districts, and a new reign of terror existed in the island. But during the next day the volcanic disturbances moderated, and some degree of calm returned to the afflicted islanders.

A cable message of date of May 22 said: "I have just returned from visiting the leeward side of the island. La Soufriere is still very active. Lava is streaming into the sea, while clouds of sulphurous smoke, extending for miles, obscure the land and compelled us to steam seaward at full speed. We rescued 120 Caribs from Cura, twenty-three miles from here. We saw another crater, between La Soufriere and Chateau Belaire, emitting stones, and also smaller vents elsewhere.

"The food of the peasantry is ruined and everywhere the island is blighted for fruit and vegetables. Cattle are being shipped to other islands for pasturage. The laborers in the sugar districts have killed their horses for food, and are now dying from diseases of the intestines caused by the lava dust."

As varied personal accounts have been given from eye-witnesses of the eruption of Mont Pelee, it seems proper to present here similar descriptions from some of those who saw the outburst from La Soufriere and escaped the mountain's wrath. Here is a brief story of the experience of a Chateau Belaire fisherman :

WHAT A FISHERMAN SAW

"I was fishing at some distance from the shore when my boatman said to me, 'Look at the Soufriere, sir. It is smoking!'

"From the top of the cone, reaching far up into the heavens, a dark column of smoke arose, while the mouth of the crater itself glowed like a gigantic forge belching a huge jet of yellow flame. The mass of smoke spread out into branches extending for miles, and clouds of sulphurous vapor, overflowing, as it were, the bowl of the crater, began to roll down the mountain slopes.

"We reached shore and started to run for our lives. We were soon enveloped in impenetrable darkness, and I was unable to distinguish the white shirt of my boatman at a yard's distance. But as he knew every inch of the ground, I held on to a stick he had, and so we stumbled on until we reached a place of safety. The incessant roar of the volcano, the rumbling of the thunder, the flashes of the lightning, added to the terrific grandeur of the scene. At last we emerged from the pall of death, half suffocated, and with our temples throbbing as if they were going to burst."

One of a batch of ten persons who were rescued, after living for several days without food or water, from a house in which five other persons had perished, gave in these words what he remembered of the occurrence :

“We heard the mountain roaring the whole morning, but we thought it would pass off, and we did not like to abandon our homes, so we chanced it. About half-past one it began to rain pebbles and stones, some of which were alight ; but then, although we were afraid, we could not leave. The big explosion must have taken place at about half-past two o'clock. There was fire all around me and I could not breathe. My hands and feet got burned, but I managed to reach the house where the others were.

“In two hours everything was over, although pebbles and dust fell for a long time after. My burns got so painful and stiff that I could not move. We remained until Sunday morning without food or water. Five persons died, and as none of us could throw the bodies out, or even move, we had to lie alongside the bodies until we were rescued.”

MRS. LESLIE'S NARRATIVE

The condition of affairs in Georgetown during the outbreak of the Soufriere was vividly described by the wife of the Rev. A. H. Leslie, a Wesleyan minister, who was in the place at the time.

“From Sunday night, May 4,” said Mrs. Leslie, “the heat had been oppressive. Never had I experienced such heat before. It was with the utmost difficulty one could breathe, and to sleep was impossible. We had no means of testing the temperature, but I am satisfied that a thermometer would have shown a record of great intensity.

“On Tuesday I learned from Mrs. Darrell that the Chateau Belaire side of the mountain was showing signs of activity. On

Wednesday morning, between nine and ten o'clock, the lightning and thunder began. Such lightning and such thunder! Oh, it is terrible to remember, and thrice terrible was it to behold! Blinding flashes that zigzagged with hissing fury and a lurid light ominous of destruction.

"Mr. Leslie said he had never before heard thunder in May, and declared the occurrence was most unusual. He left the house with the object of making some observations, and on his return he said that the Soufriere was active.

"In the meantime some fisher girls, who came down from the mountain, said they had observed the water in the mountain lake to be boiling rapidly and the grass in the vicinity to be torn up. Then, you will understand, I got anxious. The storm grew in fury. The thunder became louder and louder. Nature's forces were cannonading with a fierceness of detonation that would have awed the bravest of human hearts.

UNDER A RAIN OF STONES

"Amid the crashing thunder peals and the dreadful lightning there began to fall a shower of small pebbles, and later on there fell stones as big as your fist. Meanwhile dismal rumblings were heard, as though the mountain groaned under the weight of accumulated fury, and the earth swayed in deep sympathy.

"At half-past two o'clock the explosion occurred, and darkness fell upon the land. What words can depict the sound or tell of the sensation it caused those who heard it? Language is inadequate to the task. Vain would it be to ransack the vocabularies of dead or living languages in the hope of finding adequate terms. The sounds were weird and abysmal, and caused our hearts to quiver with fear.

“The rain of big stones continued up to about eleven o'clock at night, when sand began to fall. From where we were, we could see the reflection of the fire in the sky, but could not see the blaze. So terrible were the earthquake shocks as to give the impression that the end of the world had come. The hours of the night—that night of horrors!—crept slowly along with leaden feet, and morning was so long in coming that it seemed as though daylight had been extinguished for all time. But at last morning broke. Not a morning like the rosy-fingered mornings of tropical brightness and sunshiny beauty that we had been accustomed to, but a dull, dismal, dreary day came, not much distinguishable from the preceding night of Egyptian darkness. But it was day, and that fact afforded some measure of relief. We could see and hear others in the town.

“Numbers of persons now began to flock into Georgetown from the adjoining country, and to bring accounts of the death of this person and that person, of the extinction of this family and that family. This continued all day. The tale of death and calamity was one long, unbroken, sad, sad one. Among those who came into the town or were brought in were many who had been stricken by lightning and were paralyzed, or who had been scorched by the burning hot sand and were blistered and sore.”

The Rev. J. H. Darrell, rector of a little English church in Georgetown, describes his knowledge of the calamity in the following eloquent language:

“Never in the history of this lovely island has it been visited with such awful distress as that which now prevails. The hurricane of 1898 entailed great loss and general distress, but this never-to-be-forgotten disaster has resulted in more than five times the loss of life, as well as greater loss of property. The loss in property,

perhaps, has not been so widespread as it was in 1898, but I am certain that the total loss has been far greater in this calamity than it was then.

"I have investigated the awful tragedy as clearly as I know how, and I have made up my mind that the most of those killed died from suffocation. In their houses, on the roads, in the fields where they were at work, they were overcome in a moment and expired almost in an instant. Bodies have been found sitting upright in chairs, and others were rigid and as if about to continue the tasks in which they were engaged at the time the blast struck them."

ERUPTION OF THE SOUFRIERE

"A few slight, significant warnings were given before the present outburst," he went on to say. "Admonitory rumblings and occasional earthquakes occurred in the vicinity several days before—indications that the mountain was preparing for the majestic performance with which it has astonished and awed the inhabitants of this lovely island—but it was only on Monday, May 5, that what we supposed was a dormant volcano gave any plain indications of disquietude.

"It was on Tuesday, May 6, at 3 o'clock in the afternoon, that the mountain began its series of volcanic efforts. A strong shock of earthquake, accompanied by a terrible noise, occurred, and the volcano began to emit steam. This was reported to the residents of Georgetown by the police corporal in charge of Chateau Belaire. At 5 o'clock that same afternoon louder and more frequent explosions were heard, the detonations succeeding each other in rapidly diminishing intervals. At half-past 7 o'clock columns of steam issued from the old crater with terrific noise. These lasted until midnight, when another heavy explosion occurred. There was

another sudden and violent escape of pent-up steam at 7 o'clock on Wednesday morning, May 7, which continued ascending until 10 o'clock, when other material began to be ejected.

"It would seem that this was the time when the enormous mass of water in the lake of the old crater was emitted in a gaseous condition. By noon it appeared that there were three craters vomiting lava—the two old craters, one of which had contained the lake, and a third crater that is supposed to have been opened in the present eruption. Six distinct streams of lava were visible running down the sides of the mountain. The resurrection of the two old fiery furnaces, with the addition of a fresh crater, was something awful to behold. The mountain labored to rid itself of the burning mass of lava heaving and tossing below.

FLAME-LIKE APPEARANCES

"By half-past 12 it was evident that the mountain had begun to disengage itself of its burden by the appearance as of fire flashing now and then around the edge of the craters. There was, however, no visible ascension of flame. These flame-like appearances were, I think, occasioned by the molten lava rising up to the neck of the volcano. Being quite luminous, the light emitted was reflected from the banks of steam above, giving them the appearance of flame. From the time the volcano became fully active tremendous detonations followed one another so rapidly that they seemed to merge into a continuous roar, which lasted all through Wednesday night and up to half-past 6 o'clock of Friday morning, May 9. These detonations and thunders were heard as far as Barbados, Grenada, Trinidad and St. Lucia, and as far north as St. Thomas.

"In company with several gentlemen, on Wednesday at noon I left in a small row-boat to go to Chateau Belaire, where we hoped

to get a better view of the eruption. As we passed Layou, the first town on the leeward coast, the smell of sulphuretted hydrogen was very perceptible. Before we got half way on our journey a vast column of steam, smoke and ashes ascended to a prodigious elevation, falling apparently in the vicinity of Georgetown. The majestic body of curling vapor was sublime beyond imagination. We were about eight miles from the crater, as the crow flies, and the top of the enormous column eight miles off reached higher than one-fourth of the segment of the circle. I judge that the awful pillar was fully eight miles in height.

“We were rapidly proceeding to our point of observation, when an immense cloud, dark, dense and apparently thick with volcanic material, descended over our pathway, impeding our progress and warning us to proceed no farther. This mighty bank of sulphurous vapor and smoke assumed at one time the shape of a gigantic promontory, then appeared as a collection of twirling, revolving cloud whorls, turning with rapid velocity; now assuming the shape of gigantic cauliflowers, then efflorescing into beautiful flower shapes, some dark, some effulgent, some bronze, others pearly white and all brilliantly illuminated by electric flashes.

DARKNESS AS DENSE AS STARLESS MIDNIGHT.

“Darkness, however, soon fell upon us. The sulphurous air was laden with fine dust, that fell thickly upon and around us, discoloring the sea. A black rain began to fall, followed by another rain of favilla, lapilli and scoriæ. The electric flashes were marvelously rapid in their motions, and numerous beyond all computation. These, with the thundering noise of the mountain, mingled with the dismal roar of the lava, the shocks of earthquakes, the falling stones, the enormous quantity of material ejected from the

belching craters, producing a darkness as dense as a starless midnight, together with the plutonic energy of the mountain, growing greater and greater every moment, combined to make up a scene of horror.

“It was after 5 o'clock when we returned to Kingstown, awed and impressed by the weirdness of the scene we had witnessed, and covered with the still thickly falling gray dust. Of what this material is composed I am unable to give a certain opinion, but it appears to consist of comminuted rock, powdered by attrition of the material, as in successive outbursts it is hurled aloft and then tumbles back again to the burning crater, to be ejected finally as impalpable dust. So minute are the particles that they find their way through the finest chinks of a closed room. Large areas of cultivation have been buried under the fall of the dust. Its effect upon vegetation will probably be beneficial ultimately, but in the meantime great suffering, as well as inconvenience, is occasioned by it.”

AN EXCURSION THROUGH ST. VINCENT

An observer after the event tells of what he saw and learned in an excursion through the devastated island :

“It was only on Friday afternoon that residents of Kingstown, the capital, began to gain some idea of the disaster which had befallen the country of the Caribs, as the northern portion of the Windward coast is called. Georgetown is the centre of that once fertile and beautiful district, now a desolate waste of ashes. Between this town and the capital there is a fairly good road, running for the most part along the sea.

“The country is undulating and very picturesque most of the way, and at one time was planted entirely in sugar cane. Windmills and factories in ruins remain as good evidences of the past

prosperity of the island. To-day the cultivation of arrowroot has taken the place of that of sugar cane, and one passes field after field of broad-leaved *marantas* on the way to Georgetown.

"The journey is usually performed on horseback, but a mail wagon, which takes passengers, plies regularly along the road. It is also possible to obtain at times some sort of a vehicle drawn by mules, and it was by one of these conveyances that I proceeded to Georgetown on the day after the eruption.

"It is almost impossible to convey in writing any idea of the desolate appearance of the country beyond the fifteen-mile post; that is fifteen miles from Kingstown and seven from Georgetown. The whole place looked as if millions of barrels of cement had been emptied over the land, covering every inch of ground with a coat of dismal gray. As we proceeded I noticed that the small stones scattered about were of larger size and that the bed of dust became thicker until we reached Georgetown, where the streets were covered to a depth of three feet. The roofs of the thatched huts, unable to bear the weight of volcanic dust cast upon them, had in many cases caved in, while the trees were burnt and bare of leaves, imparting a dreary appearance to the landscape."

PROFESSOR HOVEY'S VIEWS

Prof. O. E. Hovey, of the American Museum of Natural History, of New York, one of the first of the visiting scientists to St. Vincent, gives thus his view concerning the eruption :

"The history of the eruption is practically that of the disturbance of 1812. Earthquakes occurred here about a year ago, and have occurred at intervals at various places in the West Indies and adjacent regions ever since. At least one resident of Kingstown, F. W. Griffiths, several months ago predicted that La Soufriere would

soon break out. His prophecy was not heeded until last month, when the activity of the mountain became so alarming that the inhabitants on the west, or leeward, side of the mountain, abandoned their plantations and cabins, and took refuge in the more secure parts of the island. On account of the strength of the trade-winds, it was not supposed that the eastward side of the mountain would suffer very much. This proved a painful delusion, causing the loss of hundreds of lives.

“A vast column of volcanic dust, cinders, blocks of lava and asphyxiating gases rose thousands of feet in the air, spreading in all directions. A large portion of this, having reached the upper currents, was carried eastward. This, all falling, was again divided, and the cinders and deadly gases were swept by the lower winds back upon the eastward side of the mountain. The wrecked houses show this, the windows on the side toward the crater being unaffected, while those on the farther side were wrecked by the back draught toward the mountain. There was no wind on the morning of the great outburst, a fact which facilitated the devastation of the country. The hot asphyxiating gases rolled out of the crater, and many were scorched and suffocated. Hot mud, falling from the cloud above, stuck to the flesh of the unfortunate victims, causing bad wounds. Great blocks of stone were thrown out of the eastern side of the crater, which could be distinctly seen at a distance of four miles.”

CHAPTER VIII.

The Sympathy and Aid of the United States.

THE government and people of the United States, ever ready as they have always been, to respond to the appeal of the suffering and lend their aid to the unfortunate victims of disaster of any kind, lost no time in awaking to the need of instant relief to the surviving people of Martinique. No sooner was the overwhelming shock of the first tidings of the dread disaster thrown off, than the government actively began the work of beneficent assistance, and the generous-hearted in city and country alike offered their contributions in aid of those in peril of death from famine in the ruined West Indian island. The rain of fire from the burning mountain had destroyed the supplies of food, and starvation threatened those who had escaped the volcano's awful doom. The need of immediate action was very great, and not an hour was lost.

President Roosevelt was among the first of rulers to express sympathy for France in the frightful fate which had come upon so many thousands of her subjects. On Saturday, the day after hearing of the disaster, he telegraphed as follows to the French President :

"Washington, May 10, 1902.

"His Excellency, M. Emile Loubet, President of the French Republic, Paris.

"I pray your Excellency to accept the profound sympathy of the American people in the appalling calamity which has come upon the people of Martinique. "THEODORE ROOSEVELT."

President Loubet returned the following reply :

“ Paris, May 11, 1902.

“President Roosevelt.

“ I thank your Excellency for the expression of profound sympathy you have sent me in the name of the American people on the occasion of the awful catastrophe in Martinique. The French people will certainly join me in thanks to the American people.

“ EMILE LOUBET.”

ACTION OF THE EUROPEAN RULERS

The leading rulers of Europe took similar action. On May 12th Emperor William of Germany, sent the following telegram in the French language to President Loubet :

“ Profoundly moved by the news of the terrible catastrophe which has just overtaken St. Pierre and which has cost the lives of nearly as many persons as perished at Pompeii, I hasten to offer France my most sincere sympathy. May the Almighty comfort the hearts of those who weep for their irreparable losses. My Ambassador will remit to your Excellency the sum of 10,000 marks in my behalf as a contribution for the relief of the afflicted.”

President Loubet replied :

“ Am greatly touched by the mark of sympathy which, in this terrible misfortune which has fallen on France, your Majesty has deigned to convey to me. I beg you to accept my warm thanks and also the gratitude of the victims whom you propose to succor.”

King Edward, of England, commanded the Colonial Secretary, Mr. Chamberlain, to telegraph to the Governor of the Windward Islands, Sir Robert Llewelyn, his Majesty's deep regret at the calamity which had visited the Island of St. Vincent and his sympathy with the sufferers and the bereaved. The Governor was

also instructed to spend all the money necessary for their relief, and the King sent 25,000 francs as his contribution to the fund being raised for the relief of the sufferers from the Martinique disaster.

The Czar of Russia telegraphed to President Loubet expressing the sincere sympathy of himself and the Czarina, who share with France the sorrow caused by the terrible West Indian catastrophe.

On the 12th the Pope summoned the French Ambassador, M. Nisard, to the Vatican, and expressed to him his keen sorrow on hearing of the St. Pierre disaster. The Pontiff requested that he be kept informed regarding the details of the volcanic outbreak.

The cable message of President Loubet was succeeded by the promptest measures, by Congress and the Executive alike, towards relief for the fugitives from St. Pierre.

The cruiser *Cincinnati* was ordered to proceed to the island without delay, to investigate and report upon the situation and extend aid to the survivors. The ocean tug *Potomac*, then at the naval station at San Juan, received similar orders. The training ship *Dixie* was ordered to prepare for sea and to await orders.

The action of the administration was indorsed and supplemented by the Senate, which passed a bill appropriating \$100,000 for the relief of the distressed inhabitants of Martinique. This bill would have gone through the House with the same impressive promptness as in the Senate, had it not been for the objection of a Representative, of Alabama, probably unheard of before. This gentleman expressed the opinion that Congress should await the receipt of "official details."

The Senate bill authorized the President to expend the money in the "purchase of such provisions, clothing, medicines and other necessities as he shall deem advisable, and tender the same, in the

name of the government of the United States, to the government of France for the relief of citizens who have suffered by the late earthquake in the islands of the French West Indies." The bill authorized the Secretary of War to use the necessary steamships belonging to the United States to carry its purpose into effect.

PROCEEDINGS IN CONGRESS

Senator Fairbanks, who presented the bill, requested the immediate consideration of the measure.

"Let the United States lead in the act of caring for the stricken," said Mr. Fairbanks. "She and her people never have failed yet to be moved by the cry of distress which has come up from other lands. Let us extend our sympathy for our unfortunate fellow men and send with it from our abundant stores the means necessary to succor those upon whom has fallen a sudden and overwhelming calamity. I believe that in tendering our sympathy and assistance we shall but interpret the wishes and purposes of the humane, generous American people."

When the bill was presented in the House Representative Underwood, of Alabama, did not view the matter from this generous aspect.

"There is no occasion," Mr. Underwood said, "for a legislative spasm. The reports of the situation in Martinique may be exaggerated. Some official report should be received before action is taken."

Representative Payne, of New York, urged upon Mr. Underwood to withdraw his objection. He pointed out that it was necessary to act at once. Mr. Underwood persisted, however, and the bill, under the rules, had to go over without action until Monday.

Early on Monday, the 12th, the French Ambassador called on President Roosevelt to convey to him President Loubet's reply to his message of sympathy, and to ask Mr. Roosevelt to assist in extending succor to the people of Martinique. The direct result of the Ambassador's visit was the transmission of a message to Congress by President Roosevelt, asking that \$500,000 be appropriated for the purchase of relief supplies and the expense of their transportation and distribution. The President's message was as follows :

THE PRESIDENT'S MESSAGE.

" To the Senate and House of Representatives :

"One of the greatest calamities in history has fallen upon our neighboring Island of Martinique. The Consul of the United States at Guadeloupe has telegraphed from Fort de France, under date of yesterday, that the disaster is complete ; that the city of St. Pierre has ceased to exist, and that the American Consul and his family have perished. He is informed that 30,000 people have lost their lives, and that 50,000 are homeless and hungry ; that there is urgent need of all kinds of provisions, and that the visit of vessels for the work of supply and rescue is imperatively required.

"The Government of France, while expressing their thanks for the marks of sympathy which have reached them from America, inform us that Fort de France and the entire Island of Martinique are still threatened. They, therefore, request that, for the purpose of rescuing the people who are in such deadly peril and threatened with starvation, the Government of the United States may send, as soon as possible, the means of transporting them from the stricken island. The Island of St. Vincent, and, perhaps, others in that region are also seriously menaced by the calamity which has taken so appalling a form in Martinique.

"I have directed the departments of the Treasury, of War and of the Navy to take such measures for the relief of these stricken people as lie within the executive discretion, and I earnestly commend this case of unexampled disaster to the generous consideration of the Congress. For this purpose I recommend that an appropriation of \$500,000 be made, to be immediately availing.

"THEODORE ROOSEVELT,

"WHITE HOUSE, Washington, May 12, 1902."

CONGRESS ACTS PROMPTLY.

After the message was received in the House Mr. Hemenway presented the Senate bill for the relief of sufferers by the volcanic disaster in the French West Indies, with a substitute unanimously recommended by the Committee on Appropriations, increasing the appropriation from \$100,000 to \$200,000.

Mr. Hemenway said this action was taken by the committee in view of the message from the President recommending that \$500,000 be appropriated. Generous contributions were being made by the people of the United States, and the committee believed that \$200,000 would be sufficient, at least for the present. Should it prove to be insufficient he had no doubt Congress would increase the amount. But prompt action was necessary if the people to be affected were to be relieved and rescued at all.

Mr. Underwood, who had checked legislation on this subject on Saturday, again expressed his objection to the proposed legislation. Members did not stand in the House to legislate upon their sympathies, or upon their heartstrings. The suffering people, victims of the recent disaster, were subjects of the great and powerful Republic of France, a nation whose proud boast had always been that it was able to take care of its own people.

Congress had no right to be generous with the money of the people whom it represented.

Mr. McRae said he was glad to believe that the people of the United States were willing that Congress should not only express their sympathy with suffering, but that they were willing that Congress should extend the proposed relief. He hoped that the bill would be passed unanimously, but if that could not be done, that it should be passed speedily.

Mr. Livingston said that it had been the practice of the United States ever since the republic was established, to extend aid to the suffering, even to the uttermost parts of the earth, and he did not believe that that policy would now be reversed.

The bill was passed—196 to 9. The negative votes were cast by Messrs. Clayton of Alabama, Burgess and Lanham of Texas, Gaines, Moon and Snodgrass of Tennessee, Tate of Georgia, Underwood of Alabama, and Williams of Mississippi.

Soon after the bill was passed the Senate received a message from the House announcing the passage by that body of a substitute for the Senate bill for the relief of the citizens of the French West Indies, increasing the appropriation from \$100,000 to 200,000. The substitute was laid before the Senate and was immediately passed. Mr. Cullom referred to the President's message recommending an appropriation of \$500,000 and said that the Committee on Foreign Relations, to which the message was referred, would report on it the next day. It was decided at a subsequent session to await the action of the cities and the results of the appropriation made before increasing it. If found necessary there would be no hesitancy in voting the sum suggested by the President.

Anticipating the passage of the bill, the War and Navy Departments completed their relief arrangements early in the day.

Officers were designated to take charge of the distribution of supplies by the War Department, and the Secretary of the Navy issued the necessary orders to the *Dixie*, then in New York harbor, to take supplies on board and sail with all dispatch to the West Indies.

RELIEF PREPARATIONS COMPLETED EARLY.

Assistant General Corbin, Quartermaster General Ludington, Commissary General Weston and Surgeon General Sternberg were charged by Secretary Root with the arrangement of that part of the relief measures pertaining to the War Department. After a few minutes' consultation, official orders were drafted for the guidance of the three supply departments, giving the scheme of distribution as follows :

Three medical officers, with \$5,000 worth of medical stores, etc.; one subsistence officer, with \$70,000 in stores, consisting of rice, dried fish, sugar, coffee, tea, canned soups, condensed cream, salt, pepper and vinegar ; one officer of the quartermaster's department, with \$20,000 worth of clothing supplies for men, women and children. The orders directed that these officers and stores be sent on the *Dixie*, to be distributed at such points as might be designated by the navy officer in command of the *Dixie* under instructions given by the Secretary of the Navy.

The medical officers were to render such medical aid as might be in their power in addition to the distribution of medical supplies. Rear Admiral Bradford also suggested the possible need of fresh water in Martinique, in view of the danger of the drinking water being rendered useless through impregnation with sulphur. The war water-barges at Key West and Norfolk were capable of conveying large quantities. Subsequent advices from the island, however, indicated that this was not necessary, as the island water was not

spoiled. Consul Ayme, of Guadeloupe, had made his way to Fort de France on the French cruiser *Suchet*, and was prepared to keep the Government advised of the needs of the islanders and the general state of affairs. The *Dixie* sailed on the 14th, deeply laden with relief stores.

CARGO OF THE DIXIE.

A memorandum, prepared by Commissary General Weston, shows that the commissary supplies sent to Martinique and St. Vincent cost \$59,404, and weighed 900 tons, equal to 1,800,000 pounds. Allowing one pound to the ration, this quantity would well furnish subsistence for thirty-six days for 50,000 people. Among the articles provided were rice, bread, flour, bacon, codfish, baking powder, currant jelly, coffee, tea, sugar, vinegar, salt, pepper, ham, cans of milk, chicken soup and beef soup.

The War Department was advised by Colonel Buchanan, commanding the military forces in Porto Rico, that the steamer *Sterling* had sailed from San Juan with subsistence stores of every kind and also clothing. The latter includes blankets, coats, trousers, underclothing, shoes, stockings and hats. These supplies were taken from the army stores at Porto Rico, and would be immediately replaced.

A meeting called by the American Chamber of Commerce in Paris on the 14th of May, raised over 12,000 francs of relief funds in a few minutes, and aside from the funds raised throughout France, contributions were made by the Pope, by ex-President Kruger, by officials of London, and by citizens of Berlin, the town council of that city recommending a civic donation of 40,000 marks. It need scarcely be said that the principal cities of the United States were similarly active in the good work of beneficence, each adding an ample quota to the much-needed supply.

Later action by the benevolent in Europe included subscriptions of 25,000 lire (\$5,000) by the King of Italy, and £5,000 (\$25,000) subscribed in London to the Mansion House Relief Fund, of which sum the Bank of England subscribed £1,000 and the Corporation of London £500. This was subsequently much increased. Large sums were contributed by the generous in France, amounting to nearly \$300,000. The Government of the Netherlands ordered the Dutch warship *Konigin Regentin* to proceed from the Island of Curaçoa (Dutch West Indies) to the Island of Martinique, at full speed, to assist the sufferers from the Mont Pelee outbreak. Both Chambers of the States General (Parliament) passed resolutions expressing sympathy with France. Queen Wilhelmina contributed 2,000 florins (\$820) to the relief fund.

IN THE HOUSE OF COMMONS

In the English House of Commons the Government leader, A. J. Balfour said: "We have not taken account of the most sympathetic manner in which the United States Government have, to use their own language, 'expressed their desire to share in the work of aid and rescue.' As to the manner in which this generous offer can best be accepted, the Government of the Windward Isles has already been consulted."

Mr. Balfour referred to the opening of the relief fund at the Mansion House by the Lord Mayor, and said that Canada, Jamaica and the other West Indian Islands, and the Island of Mauritius, in the Indian Ocean, had promised to help with money and goods.

"I have no doubt," he added, "that the other colonies will be equally generous. In addition, the Governor of the Windward Islands has been authorized to spend whatever sums are necessary, and the Imperial Government is prepared to supplement the contributions to any amount necessary."

The immediate and generous action of the United States won ample recognition in France, testified to by a long telegram received May 14 by M. Jules Cambon, the French Ambassador, and transmitted by him to Secretary of State John Hay in the following words:—

“Embassy of the French Republic, Washington, May 14, 1902.—Mr. Secretary of State: I have just received the following telegram from my Government: ‘The President and the Government of the French Republic, deeply moved by the sympathy evinced by the President, the Congress and the nation of the United States toward the sufferers of the earthquake in Martinique, charge you to be their interpreter in expressing the gratitude cherished by the entire French nation for their generous assistance, the remembrance of which shall live forever.’

“It is my great honor, Mr. Secretary of State, that I should be called to tender to you the thanks of France for all that the United States is doing on this sorrowful occasion, and I should be infinitely obliged to you if you would convey this expression to all the Government and Congress who have given evidence of such noble sentiments of humanity.

“Be pleased to accept, Mr. Secretary of State, the assurances of my high consideration. “JULES CAMBON.”

The Paris *Temps*, in an editorial of date of May 13, said relative to the appropriation by Congress: “This manifestation of American sympathy, on the eve of the Rochambeau fetes, tends to draw tighter the already close ties uniting the two Republics, and to constitute a guarantee of peace and of fraternity of the two nations.”

On the 21st a telegram was received from Captain Gallagher, of the *Dixie*, which had reached Fort de France, to the effect that

supplies were on hand sufficient for eight weeks, that all which urgency demanded had been done and nothing further could be suggested. Part of the cargo of the *Dixie* was unloaded, and the vessel proceeded with the remainder to St. Vincent, where the distress was reported to be greater than in Martinique.

Consul Ayme cabled the Department of State from Fort de France, Martinique, that he had visited Admiral Servan on the French flagship *Tage*, and that the Admiral requested him to officially inform the Government of the United States that there were now sufficient supplies in the colony to feed every one needing help for four months, and therefore suggested that nothing further be sent. This suggestion was accompanied by an expression of thanks. A similar message had been sent to the French Government.

OVERABUNDANT SUPPLIES

The fact seemed to be that the work of relief had surpassed the needs of the sufferers. Captain Crabbe, of the *Potomac*, cabled to that effect on the 20th, saying that the report of the distress was exaggerated, the great multitude of the inhabitants of the place having been killed. Advices to the same effect having come from Consul Ayme, as above stated, President Roosevelt suggested that the receipt of subscriptions from citizens should be suspended until further information had been received.

Sir Robert Llewellyn, Governor of the British Windward Islands, cabled to London to the same effect as regarded St. Vincent, his message stating: "All immediate wants now supplied. I have ordered timber for the construction of houses through his Majesty's Ambassador at Washington and the Governor-General of Canada, at a cost of £5,000. Please instruct those officers to co-operate and arrange for the payment,

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THE ILL-FATED ST. PIERRE, OVERWHELMED WITH DESTRUCTION
On Evening of May 8, 1902, Mount Pelee burst forth with fire and smoke. In a few moments the streets were strewn with





INTERIOR OF A STEAMSHIP AT ST. PIERRE, AFTER THE WHIRLWIND OF FIRE
Digitized by Microsoft®



ASH DEPOSIT FROM ERUPTION, ON AN ISLAND NEIGHBORING TO MARTINIQUE



DK/SILVERBYRON TREES ©

A wonderful tree of the Windward Islands, showing how Nature provides against storms and hurricanes.



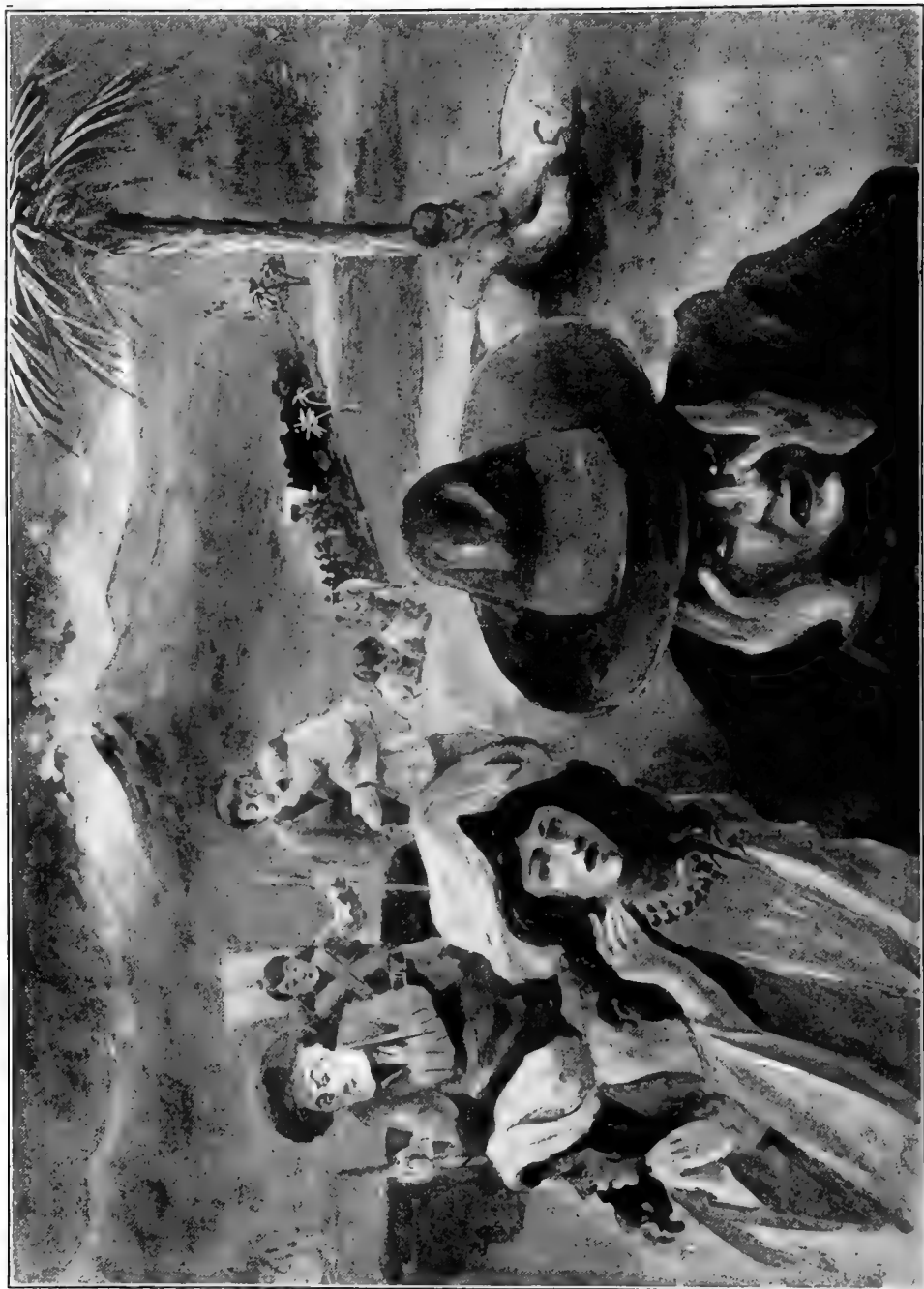
VOLCANO "MAYON," IN THE HEMP-PRODUCING DISTRICT OF LUZON

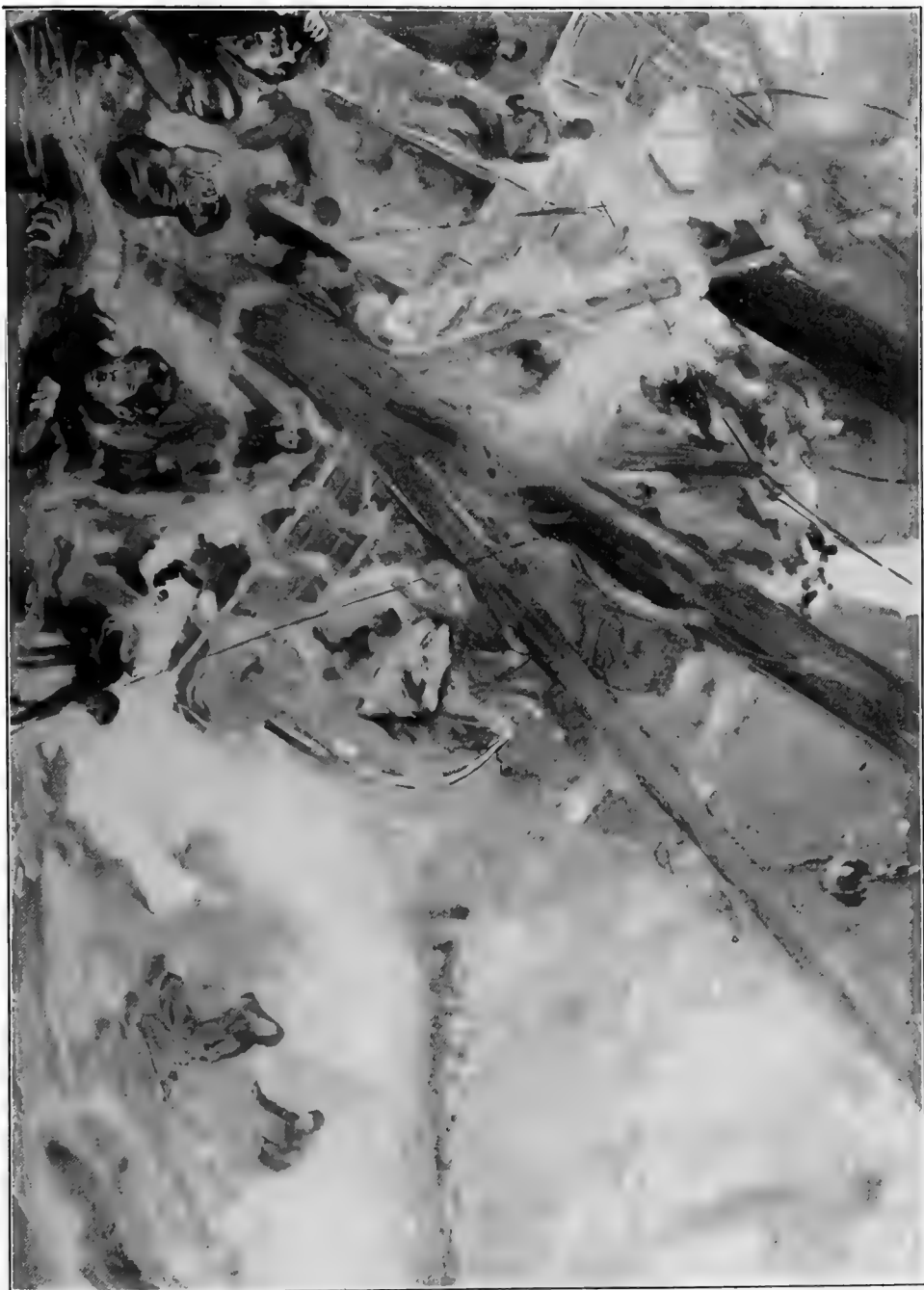
This is said to be the most beautiful volcano in the world. It is 8,233 feet high, its shape is a perfect cone and its crest is always fiery. It has indulged in several destructive eruptions

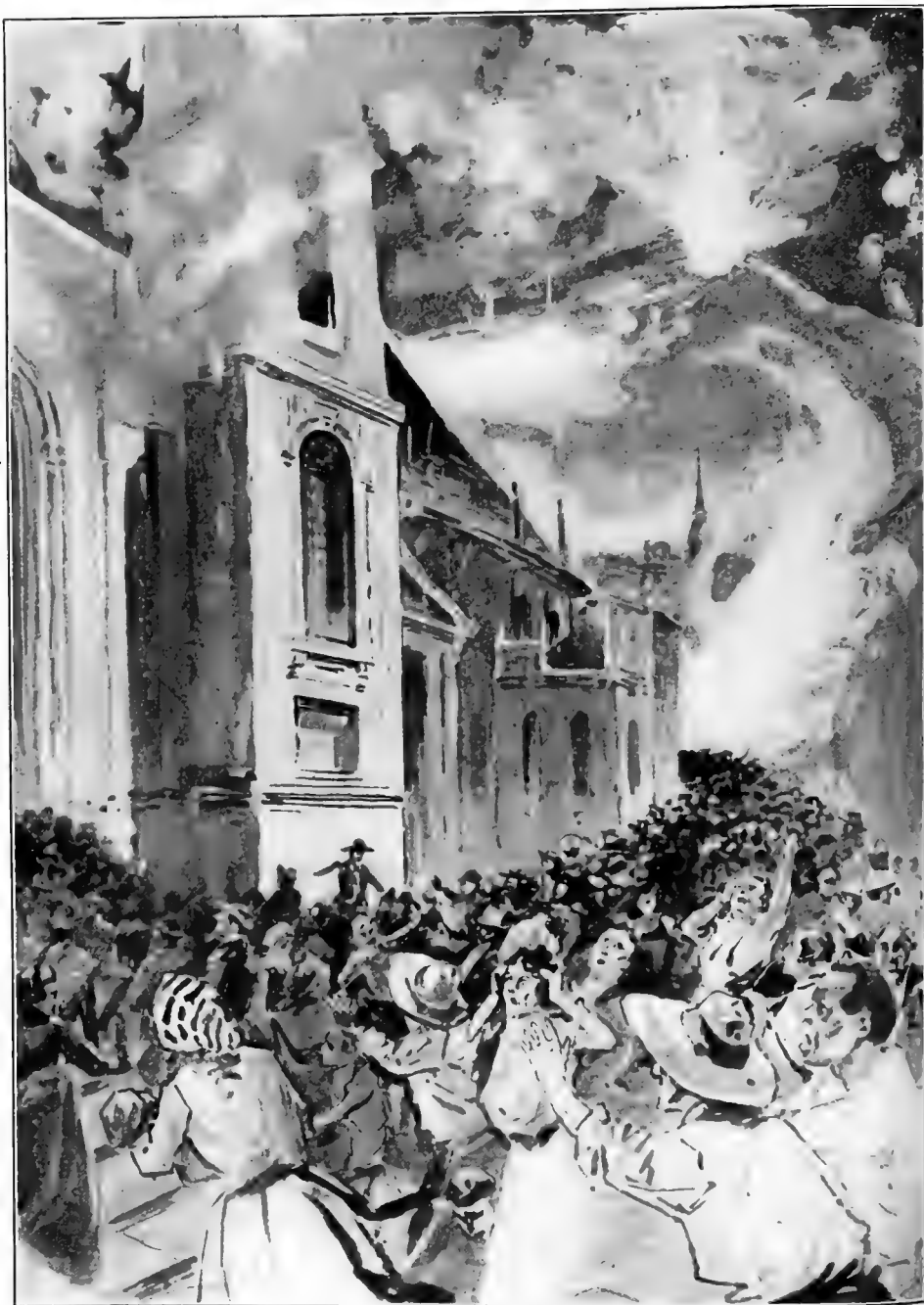


ROUSSEAU ROADSTEAD, DOMINICA, ONE OF THE SMALL ISLANDS NEAR MARTINIQUE









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SEEKING REFUGE IN THE CATHEDRAL AT ST. PIERRE

The last refuge of day before the end of the world.

“The question of the resettlement of the people is under consideration. One of the new townships is already settled. In my estimation £50,000 will enable us to support all the sufferers for six months and rehouse them in new localities. The sufferings of the wounded from burns are very terrible. Sixty deaths have occurred in the hospital.”

The suspension of relief was, of course, provisional. The renewed activity of the volcanoes rendered it possible that new disasters might occur, and fresh funds be needed. But the generous readiness with which the United States had responded to the call for aid, and the equally generous assistance offered by the warm-hearted in other lands, rendered it certain that all suffering other than that directly due to the volcano would be relieved, and that the people of the North would not rest from their work of benevolence while any suffering remained in the stricken islands of the South.

CHAPTER IX

A Vivid Picture of the Last Day of St. Pierre

IN former chapters the destruction of St. Pierre has been described and, as it were, photographed, in the graphic words of several of the few survivors of that dread catastrophe; those who saw it from the ships in the harbor and lived to tell the tale of their terrible experience. It is only through accounts like these, of those who actually went through the horrors of that dreadful day, that a satisfactory conception of the disaster can be obtained, and it is proposed in the present chapter to add the narrative of another observer, whose story effectively supplements those already given. We do this with the assurance that our readers will be gratified to read all the important accounts by eye-witnesses of the most extraordinary volcanic event of our age.

A DRAMATIC SCENE

Two French travellers of rank, Comte de Fitz-James and Baron Fontenilliat, who were on their return from a business trip to French Guiana, had the fortune to witness the eruption and the overwhelming of the city from a boat in the harbor, and the story of their experience, as given by the Comte, is one of thrilling interest. As it is the only narrative that gives a detailed account of the disaster in its most striking particulars, we append it in full. After some preliminary words, the Comte proceeds :

“Gustave Doré, in his most ecstatic delirium, never conceived anything so dramatic and so awe-inspiring as was St. Pierre after it

had been desolated by the whirlwind of fire that swept down upon it from Mont Pelee. It was more than a city of the dead. It was an inferno, magnified and realized. I looked upon it, and the vision was such that its impression will never be removed from my mind.

“From the depths of the earth came rumblings, an awful music which cannot be described. I called my companion’s name, and my voice echoed back at me from a score of angles. All the air was filled with the acrid vapors that had belched from the mouth of the volcano. I had been beaten down by the force of the explosion until I was too weary to realize the miracle that had left Baron de Fontenilliat and myself among the few survivors, and the only ones who were permitted to force our way into St. Pierre as far as the still living flames would permit. Only now my mind seems to have returned to its normal condition, and I look back upon that Thursday morning and the hours that immediately followed as upon some fearful nightmare.

“From a boat in the roadstead in front of St. Pierre, Baron Fontenilliat and I witnessed the cataclysm that came upon the city. We saw the shipping destroyed by a breath of fire. We saw the cable ship *Grappler* keel over under the whirlwind, and sink as though drawn down into the waters of the harbor by some force from below. The *Roraima* was overcome and burned at anchor. The *Roddam*, a trifle more fortunate, was able to escape like a stricken moth which crawls from a flame that has burned its wings and left it a cripple to suffer until death relieves.

“Our own danger was great, and had it not been for the bravery and the courage of the Baron I would have perished as miserably as did the thousands of wretches ashore. I was stunned, unable to lift a hand to assist myself. Baron de Fontenilliat

dragged me from the boat into the water, where he supported me until I was so far recovered as to be able to care for myself.

"If you will permit me to relate the circumstances that took us to Martinique and to St. Pierre in time to be witnesses of this great tragedy, I shall give as best I can the picture which will never leave my memory.

"Baron de Fontenilliat and I had been in French Guiana on a business trip relating to some mining property in which we are interested. It became necessary for us to leave Cayenne before the regular mail steamer, and we hired a sailing vessel to transport us to Martinique. It happened that when we left Cayenne there was something of a scare prevailing because of an outbreak of yellow fever. For that reason we were not certain what would be our reception in Martinique, and instead of going at once to Fort de France or to St. Pierre, we decided to go to Carbet, a suburban village a little way outside of St. Pierre, there to remain until the quarantine regulations were complied with. Carbet is on the opposite side of the bay from Mont Pelee and there some of the wealthiest, as well as some of the poorest, citizens made their homes.

"We learned upon our arrival that an eruption of Mont Pelee had destroyed a part of the village of Precheur, on the other side of the harbor. That was the eruption of May 3, which ruined one of the best sugar factories in the island, killing scores of workmen. We made immediate arrangements to visit the scene of the disaster. Two negro boatmen were employed to take us across the bay, and it was the fact that we made an early start the next morning that saved our lives.

BOATING IN THE HARBOR

"After breakfast, we were in the boat and had started across to Precheur by 6 o'clock in the morning of May 8; having arrived

on the island, as I have neglected to say, the previous evening. We had no thought of what was to come. Not having been in St. Pierre, we had not an opportunity to share the panic which had been caused by the ugly temper betrayed by Mont Pelee.

"It was such a morning as it is almost impossible to describe. Low hanging clouds gave the scene a dismal appearance, and this was heightened by the fine volcanic dust which filled the atmosphere, making respiration difficult. This dust was next to impalpable. It could not be seen as it floated in the air, but it settled so rapidly that my hand, resting upon the edge of the boat, was covered completely in less than three minutes.

"As we made our way across the water we more than half faced Mont Pelee, which was throwing off a heavy cloud of smoke, steam and ashes. No flames were to be seen. On shore the inhabitants were making their way about the water front. The city was to our right. Small craft plied about the harbor, some trading with the ships that were at anchor, while in some fishermen were going out to the fishing grounds, just off Carbet.

"Leaving shore, we first passed the *Roddam*, which was at quarantine, a fact to which the salvation of that ship was due. A little further out in the roadstead was the *Roraima*, its passengers on deck observing the laboring of the volcano. Still further off was the ill fated *Grappler*. Then there were several sailing vessels at anchor.

"I should have said that the calm of the morning was almost abnormal. Not a ripple was to be seen upon the face of the sea. Not a breath of air was stirring, which made it more difficult for us to breathe. But in spite of our discomforts we were glad that we had made the trip, as it was an opportunity not often given to man to see a volcano in active eruption.

“The rumblings from the bowels of the mountain were majestic in tone. I cannot tell you just how they sounded, but perhaps you can imagine a mighty hand playing upon the strings of a harp greater than all the world. The notes produced were deep and full of threatenings. There was a jarring sensation, and every now and then there was a commotion of the waters that caused a swell without making the surface break.

“Out from the shore put a small launch carrying the pennant of Governor Mouttet. The Governor at the last moment had realized that the situation was filled with a terrible danger. He was attempting to escape with his family and a few friends. I had commented to Baron de Fontenilliat upon the appearance of the Governor’s craft. Neither of us gave to the incident its true significance. [The Governor, as after evidence proved, was too late in his attempt at flight.]

“While we were talking there came an explosion that was beyond any that ever before happened. I can only liken it to a shot from a mammoth cannon. The breath of fire swept down upon the city and water front with all of the force that could have been given to it by such a cannon. Of this comparison I shall have more to say later. For the present it will do to add that the explosion was without warning and that the effect was instantaneous. Cinders were shot into our face with stinging effect.

“The air was filled with flame. Involuntarily we raised our hands to protect our faces. I noted the same gesture when I saw the bodies of victims on shore ; arms had been raised and the hands were extended with palms outward, a gesture that in a peculiar manner indicated dread and horror.

“When the frightful explosion came, our two boatmen were either thrown from the boat or with a quick impulse they sprang

overboard. It was the one thing to do to save their lives; but, unfortunately for them, they lost their presence of mind and, instead of staying by the side of the boat, they swam away in the direction of Precheur, which we were approaching when the disaster came. It was impossible for them to land at Precheur, so they were compelled to put back. They then struck out across the bay, evidently hoping to reach Carbet. We saw neither of them again, and I have no doubt they were drowned.

"My brave companion had the same impulse that actuated the negroes. He sprang into the water, and when he saw that I did not move he reached up and catching me by the shoulder, dragged me from the boat. I was stunned at first, and, though it was not a physical injury, I could not move of my own volition until the cold water restored my senses. It was thus that we could see all that happened about us.

DESTRUCTION OF SHIPPING

"The *Grappler* rushed through the water as far as her anchor-cable would permit. Then she seemed to rise by the bow, and when she settled back she sank almost before the force of the explosion had spent itself.

"The *Roraima* was all a mass of flames for several seconds. We could see the poor wretches aboard of her rushing about in a vain attempt to escape from the fire that enveloped them. Captain Muggah—or, at least, I suppose that it was he—made an attempt to give orders to the maddened crew. Then he staggered to the railing and fell overboard.

"The *Roddam* was also overcome. Her gangway was over the side. Her upper works were wrecked, but by heroic effort those on board were able to let slip the anchor chain, and, after many

attempts, the ship began to move. She literally crawled away. It was a splendid display of courage. At least three hours elapsed after the explosion before the *Roddam* cleared the harbor.

"On shore all was aflame. The city burned with a terrible roar. We realized that the inhabitants had all died, as not one was to be seen making an attempt to escape. Not a cry was heard save from the ships that were in the harbor.

"Our own condition was desperate in the extreme. The heat was intense. We were able to keep our faces above the surface of the water for a second at a time at the most. We would take a mouthful of air and then sink into the water to stay there until forced to come to the surface again. This lasted only about three minutes. After that we were able to float by the side of the boat, dipping only occasionally.

"The water began to get so warm that I feared we had escaped roasting only to be boiled to death. In reality the water did not get so warm as to be uncomfortable. That at the surface was many degrees warmer than that a foot below.

UNDER BLACK AND YELLOW CLOUDS

"When we gave our attention to the panorama that was spread before us, the entire city of St. Pierre was mantled by a dense black cloud. Our eyes could not penetrate it, but it lifted a few seconds, revealing below it a second cloud, absolutely distinct from it. The second cloud was yellow, apparently made up of sulphurous gases. It lifted as did the first, both rising like blankets, and in a similar manner they floated away. Then, as the yellow cloud lifted from the earth, we saw the flames devouring the city, from which all show of life had disappeared, dissipated by the magic worked by Mont Pelee.

“When we could sustain the heat that filled the air we clambered into the boat and rowed back to Carbet. The *Roddam* had just gone out from the harbor, the *Roraima* was a smoking wreck, the *Grappler* had disappeared entirely, and little was to be seen of the other craft.

“At Carbet we found the village absolutely deserted. Two portions of it had been ruined. That which was down by the water’s edge had been swept by the great wave which followed the explosion. I have neglected to refer to that wave before, but it was of terrific force, and it added to the confusion all along the shore. Part of Carbet had been struck by the wave of fire from the volcano, but the greater portion of the village was left uninjured.

“When we got ashore we called aloud, and only the echo of our voices answered us. Our fear was great, but we did not know which way to turn, and had it been our one thought to escape we would not have known how to do so. It was about one o’clock in the afternoon when we reached shore. Our weariness was beyond description. Sleep was the one thing that I wanted, but I overcame the desire and, with Baron de Fontenilliat, set off to make our way to St. Pierre, hoping that we might still render some assistance to the injured.

SOLDIERS DO HEROIC WORK

“Not knowing the paths, we attempted to enter the city from the direction travelled by the blast of the volcano. That brought us to the flames and we were driven back. Then we went further into the country, and so happened to meet two soldiers who did work of as heroic a nature as was ever accomplished by man.

“The soldiers had been in camp at Colson, far back from St. Pierre, but, on leave, had wandered in toward the city. They heard

the explosion and rushed down from the hills to give aid where it was needed. When they went in through the streets it was at the risk of their lives. They were the only ones who ventured into St. Pierre that afternoon. They came upon a sailor so injured that he could not move. Picking him up, they carried him back out of the danger zone. They left him on a couch of grass, and neither they nor we ever learned what was his fate. It is probable that he died.

“Again entering the city, these two heroes found five women in a hut. They were much injured, but were not dead. The soldiers gave them drink and put food within their reach, and then left them, promising to return with assistance as soon as possible. When they met us they told us about the women, and Baron de Fontenilliat and I made an attempt to find the hut, but were not successful in our search.

HOW HEROISM WAS REWARDED

“Now, to show the folly of those upon whom responsibility fell in that hour of terrible disaster, I may say that when those two soldiers reached their camp they were sent to the guard-house for having remained away after hours. They told of the five suffering women, and their officer insisted that the tale had been arranged by them for the purpose of escaping punishment. They were kept under guard all Thursday night and all of the next day and the following night.

“During those thirty-six hours the two soldiers made no complaint of their own treatment, but they continued to beg that assistance be sent to the women whom they had left so badly injured. Finally their plea prevailed, and on Saturday they were permitted to lead a rescue party to St. Pierre. Then their story was fully verified. One of the women was still alive. She told how the

soldiers had rescued her and her four friends, who had died late Friday night. She was taken to Fort de France, where she died a few days later.

"Had the story told by Valant and Tribul, as these brave fellows were named, been acted upon when first given, five lives would have been saved. It is our greatest regret that we were unable to find the hut in which these women were hidden. But we did the best we could. After we learned what had happened we saw that the record of these two men was not blackened by the sentence which a petty officer had passed upon them. When they return to France they shall be my guests.

"Our shoes were burned to a crisp, but we plodded about those hills as long as we were able to move. Then we returned to Carbet, and remained there that night. We were all alone, and it was not until the next morning that some of the inhabitants returned. We remained there, doing what we could, until Saturday, when we walked to Fort de France. There we remained until Monday, May 12, when we returned to St. Pierre with one of the official relief parties.

"It was on Monday that we took pictures of the disaster, and also that we met Captain McLean, who had just brought the American cruiser *Cincinnati* to Martinique. He did great work, as did other Americans.

DEAD BY HER BOX OF TOYS

"It is impossible to describe even in the most faint manner the horrors of St. Pierre. There were some things that can be made clear, but many more that cannot be explained by anything known to human reason.

"It happened that one of the first bodies found by the party with which we entered St. Pierre on Monday was that of a pretty

little girl about four years old. She sat in a life-like position by the side of a box containing her toys. But how shall we explain the fact that the house in which she was found was in absolute ruins, and, instead of being under the debris, the body was on top of it all? It was as though the little girl and her box of toys had been lifted into the air, and, after the building had fallen into ruins, had been dropped back to earth.

“So it was in the streets. The explosion happened just before eight o'clock. It was a feast day. Mass was called for eight o'clock, and many were on their way to the cathedral. All of these had been lifted into the air, and after the ruins had fallen the bodies dropped back.

“When melinite explodes in the hands of a man it is always the case that his clothes are blown from his body. So it was at St. Pierre. All of the bodies were naked, save for the shoes. Moreover, the clothing had not been burned off, as has been so often reported. The only bodies touched by fire were those that remained where the houses burned after the explosion.

TREES TORN UP BY THE ROOTS

“We saw the body of a beautiful young woman. Fire had not touched her, but her clothing had been torn from her body. She rested on her back, and under her was just a scrap of her underwear, and it showed that it had been torn, and not burned. This is something I cannot understand, for the heat was intense.

“We saw great stones that seemed to be marvels of strength, but when touched by the toe of a boot they crumbled into impalpable dust. I picked up a bar of iron. It was about an inch and a half thick and three feet long. It had been manufactured square and then twisted so as to give it greater strength. The fire that

came down from Mont Pelee had taken from the iron all of its strength and had left it so that when I twisted it it fell into filaments, like so much broom straw.

"Back of the cathedral was the savannah. Great trees had been torn up by the roots, leaving holes twenty feet deep and thirty to forty feet across. Then these holes had been filled by the ashes that poured down from the volcano. Trees were cut off as though by a mighty knife in the hands of a giant reaper. Everywhere were banks of cinders and ashes.

"When the Baron and I first went into the ruined city we were too awe-struck to speak. Then I found tongue, and I called to him. His name echoed back to us from a score of standing walls. All about us were bodies. On few faces was to be seen that peace which I have seen mentioned by others. I believe that almost all had time to realize what was upon them, but they did not have time to suffer. Their arms were outstretched, as I have before remarked. The hands were open and the fingers were spread. It was a common gesture, and I believe that it was the act of men and women who threw up their arms to ward off a blow which they knew was descending upon them.

"There was another fact which has not been remarked upon as it deserves. I know that the explosion of Mont Pelee was not accompanied by anything like an earthquake, for the reason that when we entered St. Pierre we found the fountains all flowing, just as though nothing had happened. They continued to flow, and are flowing still, unless destroyed by the later explosions.

"There was no flow of lava. It was all ashes, dust, gas and mud. Therein lies another fact which must be considered. It should be remembered when discussing this catastrophe that the crater that sent disaster upon St. Pierre was not at the crest of the

volcano. The old crater was at the top, and it was filled with water, forming a pretty lake. The first eruption, which sent destruction upon Precheur, was from a crater far down the side of the mountain. The destruction then was worked by mud.

FORCED OUT THE MOUNTAIN'S SIDE.

“ Now the water in that lake disappeared a little before the eruption of May 3. There had been constant and heavy rains. Then a small peak of the mountain fell in and covered the crater from which the hot mud had been pouring. I am convinced that that fall of earth, stones and water closed up the vent, and when the pressure on the inside became sufficient it forced out the side of the mountain.

“ It is a fact that a new crater formed, and it pointed in the exact direction of St. Pierre. That crater is in the mountain side, and I referred to it when I said that the explosion was like that of a cannon. It was aimed at St. Pierre, and the result was that the hot gas, the stones and the boiling mud were forced down upon the city, just as the gas is forced from the mouth of a cannon.

“ It is true that there was one survivor of the disaster—a prisoner who was confined in a dungeon far below the surface of the earth. He was released four days after the destruction of St. Pierre, and after he had suffered the tortures of the damned. It would seem that he might have been left at liberty, but he has been returned to a cell in the prison at Morne Rouge. I was told about the prisoner by a priest, who assured me that the disaster had fallen upon St. Pierre as a direct act of Providence, and as punishment because the inhabitants were wicked and did not attend church as they should have done.

“ I wish to refer to the action of the authorities who assured the inhabitants that nothing was to be feared from Mont Pelee. Had the opposite course been taken many would have escaped. But the assurance of safety was given, and as a result the daily paper published in St. Pierre the day previous to the destruction of the city contained a long editorial intended to lessen the panic. That editorial concluded with this expression : ‘ Where then, can one be more secure than in St. Pierre ?’

“ Looting was carried on in St. Pierre from the moment that men dared to venture back into the city. When we were there on Monday, May 12, we saw many skulkers, who were robbing the dead. The action of the authorities was not all that might have been desired. More of this will be said when we reach Paris.

“ Of supplies there are now enough to make famine impossible. All the world seemed to rise with an impulse of generosity. Provisions were taken to the island by every ship that arrived there. The refugees were fed better than they were before the disaster happened.”

CHAPTER X.

St. Pierre Before and After Its Fall.

WE owe to a correspondent of the New York *Herald* the following eloquent description of the state of affairs in St. Pierre during the week preceding its destruction :

“It is not so very long ago since I visited this poor St. Pierre—this now city of the dead. It had, I am told, undergone but few changes until the coming of that frightful day which changed it so utterly.

“To say that St. Pierre was the most picturesque of West Indian cities is to say too much ; to say merely that it was a pretty place is to say too little. Where now is all aching desolation, a chaos of ruined walls, blackened stumps of trees and sickening stench, there basked in summer sunshine a little city splashed throughout with vivid color—red-tiled roofs cutting sharp lines on walls of creamy white, of yellow and orange and bird’s-eye blue, mingled with the green of tropic verdure. Built on a long undulation which sloped to the sea, where it clustered in a riot of color near the shore, its suburban spots could be picked out here and there along the flanking spurs and foothills which roll from Pelee’s base, that great volcanic bulk whose crest is ever shrouded in a veil of clouds.

MAY OPENS ON ST. PIERRE

“Over the doomed city the morning of May 1 broke in miracle-like splendor, skies bright and blue, and foliage washed to a fresher green by a hard rain which had swept over the island the preceding

night. But it was the last fair day that St. Pierre was to know. Its light-hearted folk had hardly awoke to that jocund morn before long-slumbering Pelee gave signs of its self-awakening from its half century of sleep.

"The marketplace, the first section of the city to show life when a West Indian town awakes, was filling with venders and purchasers when the first mutter of the sleeping giant was heard—a deep-toned, jarring growl, which instantly blanched the faces of all who heard, for those bred in the shadow of the volcano had long since learned to dread its wrath, and, growing up, these in turn had taught to other generations the malevolence of that giant bulk. Startled eyes were turned to the gloomy mountain and were reassured to see it still quiet so far as vision went, for its top was hidden in a white mist, and there was no sign of boiling lava and no fall of hurtling rocks.

"Those who by chance were in the city that morning, and who, by far luckier hazard, were out of it before its fall, tell of how short-lived the first fright was and how quickly the mercurial population regained its buoyant spirits. Some there were who looked grave when ashes white and fine as powdered magnesia began to sift from out the great cloud which hung over Pelee's crest, but it seems that none thought connecting these myriads of floating particles with the deep, muffled rumble which had just been heard; none to trace the one to the other—the effect to the cause. Their minds were not grooved to such analysis; they were too simple, too West Indian for that. Sufficient that the rumble had gone. As for that sifting of fine ashes which got into the nose and eyes and made one sneeze and cough, *quien sabe?*

"St. Pierre was gay that night of May 1. The municipal band gave music in the plaza, as was its wont on Thursday

evenings. This band-night was the one occasion when youths and maids might mingle in public, and the young gallants and mademoiselles, promenading around the square under the watchful eyes of fathers and mothers and duennas, talked lightly of Pelee and that whitening fall. Up near Morne Rouge, abode of St. Pierre's well-to-do, there was a lawn party that evening, which carried its gayety far into the night—zitzas tinkling in the tropic air, and mantilla-draped girls dancing in the moonlight to the click of castanets.

A DAY OF EVIL OMEN

“Friday, day of the evil omen, dawned over St. Pierre. It was made sombre by a thunderstorm, which brooded over the mountain, and from whose dark clouds came intermittent flashes of lightning. The nervous started at every thunderclap, and anxiously asked one another if that was not Mont Pelee, while others sought to trace the blinding flashes to their source, to see if they were really the mere play of lightning, or were volcanic blazes from the timeworn crater, which many believed, and all hoped, was long ago extinct. Then a heavy mist settled over the city and its surroundings, and under its depressing influence the day wore itself to a close.

“Saturday, May 3! Just five little days to obliteration, to death, utter, wholesale, sudden and tragic! And yet St. Pierre went forth that day to carnival doings, local celebration in honor of something or somebody. Facts are meager as to the life of that day and of the ones that followed, for it must be remembered that none survived the horror that was so soon to come. But there were some who had spent days in the city just previous to the tragedy—some who had left it only a scant half hour before the holocaust.

"Grieving for their own lost dead and with nerves unstrung by the narrowness of their own escape, it may be that their overwrought minds are coining visions now, but these tell earnestly of a column of smoke which arose, black as a pall, from Pelee's white shroud, to rear its billows of crape into the form of a great upended coffin. However that may be, there is evidence that all festival gayety ceased when showers of pebbles began to rattle over the city, with now and then a fall of sand, whose grains were hot to the touch, despite their long flight through the air.

IN MORE SOBER HUMOR

"St. Pierre, it is now said, was in a more sober humor that evening than it had been within the memory of those who tell disjointedly the tale of the days that ushered in its doom. And when on the next morning—Sunday, that was—another growling note was heard from Pelee and a small river of hot, black mud, touched here and there with red, was seen to come snaking down from out the mists screening Pelee's summit to cascade over a hundred-foot precipice, and then to follow the line of least resistance until it swirled about the Guerin factory, setting that building ablaze and destroying many lives, then apprehension grew into fear and might soon have lapsed into a panic, which doubtless would have saved, through flight, the lives of the thousands that were so soon to be sacrificed.

"It was at this crisis that the hand of the Government appeared. To Fort de France, seat of local authority, had come reports of the uneasy feelings of those dwelling in St. Pierre, Martinique's commercial centre. It is thought that Governor Mouttet honestly believed there was no cause for alarm, and that a panic in St. Pierre would work disaster in many ways, interrupting

commerce and injuring the whole island as well as the threatened city. He, if none other, realized that an exodus from the place would be a tacit acknowledgment of the danger that lurked in the volcano, which all in Martinique would have the world believe was long ago extinct ; never to be restored to the list of those still active, nor yet classed with those that are dormant.

THE GOVERNOR'S ACTION

“So it came about that the Governor saw fit to exercise moral restraint, it not being within his province or within that of any other man to use physical force in a matter of this kind. In St. Pierre there were some government employes, among them gray-beards who had spent years in volcanic regions and who knew something of the preliminary warnings which come from these excitable hills. When the lava-like stream came pouring down from Pelee, these at once made hurried applications for leaves of absence. The Governor sought to make an example of the youngest, and in a communication to him denied the application for furlough ; saying moreover that if the applicant quitted his post at the time his position would be taken from him. This man—unfortunately names are hard to obtain just now from Martinique’s hysterical population—promptly decided that his life was worth more than his place, and, packing up his belongings, went with his family to some point inland, just where no one seems to know.

“It seems that the others were not so hardy, or were more so, according to one’s way of looking at it. At all events, when the Governor’s dictum was known, all the government employes decided to remain, and as fear loves company no less than misery does, these affected to make light of the danger so as better to induce the others to remain.

“ Out in the bay was anchored an Italian vessel, a craft which had come in a few days before and which was to have awaited there instructions from her Genoese owners. After the rain of pebbles and sand and the stream of mud, the captain went to his Consul and notified him of his intention of immediately putting to sea. ‘I know nothing of Pelee,’ the master said to the Consul, ‘but I have lived in Naples and I know Vesuvius.’

“ ‘That man,’ reflected the Consul after the mariner had made a hurried exit from the consulate, ‘apparently knows about volcanoes.’ And within the hour the Consul and his family were hastening to a place of safety.

“ Monday, May 5.—Less than eighty hours and the 30,000 lives of St. Pierre are to be blotted out as quickly as one snuffs a candle. Fear is rife among the populace the morning of this day and an unwonted silence pervades the city—the hush that precedes great tragedies. Macaws and parrots squawk discordantly from cages, fountains tinkle merrily, seas and skies are blue, but pervading all is an air of expectancy—of dread. Few have yet left the city, but it would take little now to turn every street into a struggling stream of humanity fleeing panic-stricken from the vicinity of that awful volcano. From tales I have heard one can easily conceive of what a trampling rush might have followed some tocsin alarm—such a mad rush for safety as theatre crowds are wont to make when the cry of ‘Fire’ is heard,

NONE TO GIVE WARNING

“ But there was none in Martinique to give needed warning—not even Pelee. All that day and the next and the next the volcano smoked, and at intervals emitted clouds of ashes,—finely pulverized pumice the chemists say the ashes are composed of,—but

the wind sent the smoke and ashes away from the city, and while the rolling clouds were seen from far-off points and the ashes fell on the ships half a hundred miles away, none in St. Pierre seem to have known that the mountain was even then pouring forth smoke and ashes.

“What the residents did know was that a commission of geologists had been appointed by the Governor to survey Pelee and to report upon it—to say whether there was danger there or not. Then, too, the Governor himself was coming, and, moreover, his family were coming with him. Could there possibly be any danger where so eminent and so important personages as these were? Also, a company of soldiers from Fort de France were coming, and while the St. Pierreans were talking of their arrival the company appeared. It seems singular that the presence of this small band of soldiery should have inspired a misplaced confidence, but so it was, though none seem to have asked what good the soldiers could have done, or what even the mightiest army could have effected against volcanic Pelee.

THE VILLAGE OF CARBET

“Wednesday night—eve of horror! There are none left alive to tell what the city was like that night, but just around a little promontory at its southern edge nestles the village of Carbet, a pretty town of some six or seven hundred people, not one of whom was hurt, the town having been screened by a high ridge which lay between it and St. Pierre and runs sheer to the sea.

“Its northern wall is precipitous, and built close up to it was the southern section of St. Pierre, a thickly populated district whose houses left barely enough room for streets, the buildings huddling close to the steep and wooded acclivity as if seeking to escape from that crowded quarter and to consort with village neighbors on the

other side of the ridge. The intervening distance was short. By the broad, finely graded, bridged and tunnelled highway which connected city with village, one would judge that a five minutes' brisk walk would be amply sufficient to reach the one from the other.

"But none sought safety by that road—at least none escaped by it. The heartbreaking pity of it all is that safety was so near—at the end of one's finger almost. For just over the ridge the grass and palms are everywhere as green as any in the tropics to-day, while up to the very crest of its northern slope are the ineffaceable marks of ruin and disaster. It was as if some sea of flame had brimmed to the very crest of the ridge, to suck back again before overflowing on the other side.

DESTROYED IN A FLASH.

"So it is to the village folks of Carbet that one must turn now for the last act in this horrible tragedy. Night fell, the villagers say, with an unnatural, unearthly quiet. Not a breath of air to stir the palms fringing quiet shores; not a ripple to break the mirrorlike clearness of still waters. It was as if the hush of death lay everywhere. True earthquake weather, more than one of the villagers observed, as they noted the oppressive stillness of the air and the strange quiet of the racked earth.

"Thomas T. Prentis, United States Consul at St. Pierre, was sitting on the veranda of his home in early hours of the following morning. A friend came driving by in a buggy.

"'You had better get out of this,' he called to the Consul. 'I am getting out, and getting out as fast as I can.'

"'Oh, you are just merely a little scared,' Mr. Prentis replied. 'There is no need of any one going away.'

"'It is better to be safe than sorry,' retorted the citizen, as he whipped up his team and hastened on.

"It is from this man, who witnessed the disaster a short time later from a neighboring elevation, from the few who survived the wreckage in the offing and the few who looked on the cataclysm from distant points, that the only eyewitness version can be had.

"The hour of the disaster is placed at about 8 o'clock. A clerk in Fort de France called up another by telephone in St. Pierre and was talking with him at five minutes to 8 by Fort de France time when he heard a sudden, awful shriek and then could hear no more.

"The little that actually happened then can be briefly, very briefly, told. It is known that at one minute there lay a city smiling in the summer morning—that in another it was a mass of swirling flames, with every soul of its thirty thousand writhing in the throes of death. One moment and church bells were ringing joyful chimes in the ears of St. Pierre's thirty thousand people—the next the flame-clogged bells were sobbing a requiem for thirty thousand dead. One waft of morning breeze flowed over cathedral spires and domes, over façades and arches and roofs and angles of a populous and light-hearted city—the next swept a lone mass of white-hot ruins. The sun glistened one moment on sparkling fountains, green parks and fronded ponds—its next ray shone on fusing metal, blistered, flame-wrecked squares and charred stumps of trees. One day, and the city was all light and color, all gayety and grace—the next and its ruins looked as though they had been crusted over with twenty centuries of solitude and silence.

"St. Pierre to-day is a vast charnel house. Skirting for nearly a league the blue waters of the Caribbean, its smoking ruins are the funeral pyre of thirty thousand people, not one of whom lived long enough to tell adequately a story that will stand grim, awful, unforgotten as that of Herculaneum, when the world is older by a thousand years.

"St. Pierre is as dead as Pompeii. If men be found with hearts stout enough to build again beneath the steaming maw of old Pelee, a new city can rise only on the ruins of the old. St. Pierre is not only dead, but buried. Most of her people lie fathoms deep in a tomb made in the twinkling of an eye by the collapse of their homes, and sealed forever under tons of boiling mud, avalanches of scoria and a hurricane of volcanic dust.

"Above the miles of piled debris rise here and there the relics of her ten thousand homes and commercial factories, ragged walls, rent, seamed and seared by fire. Fit monuments they are to the myriads of dead beneath, who are victims of the most heart-rending calamity of modern times !

HOMES UTTERLY VANISHED.

"In other parts of the city not even a roof peak or chimney thrusts its top through the sea of scoria. In the section known as the new town, winding up the slope of the mountain from the crescent of the roadstead, many of the city's most pretentious homes have utterly vanished, as a Swiss chalet is swept from sight by the rush of an Alpine avalanche. At such points one is spared all the grewsome horrors of the scene elsewhere, for Pelee has covered them under a pall of ashen dust as soft, impalpable and smooth as drifted snow, with only a scurry blown from the surface now and then into the blinking eyes of the explorer, blinded by the dazzle of the sunlight on the billowy gray-white surface of this volcanic grave.

"Old Pelee breathed upon the city, and under his dragon breath fair St. Pierre shrivelled, crumbled and burned, as the wing of the moth is scorched in the flame of the torch. He breathed again and shrouded the dead city under a pall that mercifully hides in spots the ghastly relics of her former comeliness.

“Over the entombed city the volcano from a dozen vents yet pours its steaming vapors in long, curling wreaths that mount thousands of feet aloft, like smoking incense from a gigantic censor above the bier of some mighty dead.”

From the story of a *Herald* party, who explored the ruins of St. Pierre some ten days after its destruction, we extract the interesting details next given. They picture clearly and graphically the state of affairs visible in the stricken city.

“With little difficulty a landing was effected on the Marina directly in front of the ruin of the large rum warehouse of Lasser Frères. The wharves in front were littered with an inextricable tangle of rum casks, barrel hoops and staves, heavy iron anchor chains, piles of conch shells and other maritime debris. The heavy masonry walls of the building, falling outward, had tumbled great masses of stone and shattered machinery over the entire area, and the powdery coverlet of fluttering dust had swathed the whole in a cloak of neutral gray. Up to the second story above the ground the thick stone walls of the front still stood, though seamed and tottering.

STRUCK DEAD AT HIS POST

“Here in the main doorway, at the very threshold of the place where he had toiled, was seen the first mute relic of human tragedy—a negro, broad-shouldered and strong; he had been a stevedore or warehouse porter probably. The stone arch of the doorway had saved him from being crushed under the falling walls and the masonry had shielded the body partially from fire. The sleeves of his shirt had been rolled up to the elbows. Death had found him at his daily task and struck him down where he stood, or, perchance, had caught him in one desperate effort at flight through the doorway toward the harbor so close beyond, whose waters were

soon a seething caldron under the blast of fire that scourged both land and sea.

“Along the water front the piled debris was not so formidable as seriously to impede a good climber, but the moment one sought to penetrate to Bouille Street, the next thoroughfare back from the shore, he encountered difficulties that called for the skill of an Alpine mountaineer. Mingled masonry, crumbled mortar, mud and ashes formed a foul, noisome series of hillocks, beneath which the dead lay in thousands. At every step the explorer encountered relics suggestive of the simple home life of the people. The wheels and pendulum of a mantel clock were kicked from out the debris as the party shuffled through the flying dust. The end of an old spring bed projected amid the ruins of a private house, and close beside it the relic of a human skull and the fragments of a spinal column indicated all that was left of its possible occupant.

• IN A TANGLE OF RUINS

“Pushing through Bouille Street to the northward, the tangle became more and more intricate. Here and there the stone walls of the taller buildings, cracked and crumbling, leaned menacingly outward toward the centre of the street. Seamed and rent with jagged cracks from base to top, they looked as though the slightest jar might bring them tumbling about the heads of those who ventured through. There had been commercial houses here, and in a dozen places iron boxes and small safes had been routed out of the ruins and their fronts torn open by means of crowbars and other heavy tools. In some cases this had been done by the legitimate heirs to the property. In too many instances there were evidences of the alert industry of the looters and ghouls who had come only to prey upon the city of the dead. In the deep gray powder

that covered the surface of all things visible could be traced the footprints of the looters and of the rescuing parties who had traversed the ground before. Save for these the only evidences of life in the stricken town were the footprints of the sea-birds along the strand.

"Here on the left is heard at last a sound. In the deathlike stillness it strikes upon the ear strangely. It is the ripple of gurgling water. Tracing it to its source, we find a water pipe, the nozzle of which projects through the shattered wall of a private dwelling. From it the water, in pure, crystal plenty, is pouring down and welding the masses of ashes and cement beneath like powder into a sticky paste. St. Pierre's streets, with their trickling rivulets of mountain water, had been the pride of her citizens. Through all the blast of fire at least this remnant of her water system had survived."

"One of the party approached the trickling water to lave from hands and face the choking accumulation of dust. As he did so he stepped back and paused. Directly below where the water fell lay huddled the grizzled remnants of a dead family.

"From this point the party, with difficulties increasing at every step, pushed further up the slope toward the heart of the town and into Victor Hugo Street. Progress here was made rather by climbing than by walking. At every step bent and twisted iron girders, pieces of steel shafting, tons of tumbled masonry and piles of half burned corpses barred the way. One sought instinctively to turn his steps so as not to desecrate the dead, but try as he might, at every footstep his feet scuffed up the dust that uncovered the ashes of another corpse.

"Through Victor Hugo Street we penetrated to what had been the Cathedral de Moullace. Had it been hammered for a fortnight

under the guns of a fleet of battle ships its ruin could hardly have been more complete. Aloft in the remnant of the higher of its two towers a pair of bells yet hung tottering in the belfry. There for scores of years their mellow peal had summoned the pious Catholics of St. Pierre to early masses. But the peak of the tower, smitten by the resistless blast, had been detached bodily, together with the heavy iron framework supporting the largest bell of the chime, and the whole mass, twisted, bent and afterward welded in the fiery furnace, lay half buried forty feet away, in the court of what had been the parish house. Of that structure, which had adjoined the cathedral, and which, like it, had faced upon the Place de Moullace, not a fragment was left save its foundation walls.

“In what had been its centre could still be traced the circular basin from which had spurted a pretty fountain of water. It was filled now with ashes, mortar and dust, through which projected the fragments of human bones.

ONCE A LITTLE EDEN.

“Directly in front of the cathedral and the parish house was the Place de Moullace. A little Eden it had been, green and fresh with the verdure of the cocoanut and the royal palm, under the shade of which the residents of St. Pierre were wont to gather in daily gossip. Not so much as the stump of a tree remained to indicate the former beauties of this little bit of tropical paradise. Trees sturdy and tall as many of the beautiful elms of Central Park had been shorn off and shrivelled under the blast, and then their stems had been literally uprooted and sent hurling through space against the wrecked walls of the church.

“Nowhere was stronger evidence presented than here that the cataclysm was explosive in character. Nowhere else in the silent

city were the visible dead marshalled in such awful hosts as in the immediate vicinity of the cathedral and the Place de Moullace. One could not escape the thought that, gay and mercurial as was the daily life of St. Pierre, its citizens had flocked in greater numbers than usual to the shadow of the cross during the four days of anxiety and final panic that preceded the climax.

“When Pickett on the last day of Gettysburg hurled his legions in the final assault upon Hancock’s Second Corps, it was said that over the ground traversed by that great charge from Seminary Ridge to the point held by Webb’s Philadelphia brigade a man might have walked literally upon the bodies of the slain. Could he have done so, he must have picked his way. In the Place de Moullace of St. Pierre, and immediately surrounding the cathedral, one could hardly so pick his way as to escape walking upon the bodies of the dead. It was no exaggeration when Consul Ayme, of Guadeloupe, said that the streets of St. Pierre were paved with the corpses of her citizens.

“Some crude effort had been made to destroy by fire the grewsome relics spared by the original cataclysm, but the work had been done all too ineffectively. Fagots of driftwood, piled around and above heaps of the slain, had been fired by negroes employed for that purpose, but the work of cremation was only partly accomplished. From a sanitary point of view it is fortunate for Martinique that the vast majority of those who died when her chief city was annihilated are buried so deep as to need no better sepulchre.

“Within the walls of the cathedral the ruin was complete. Even the altar was not spared, though one of the earliest rescuing parties upon the ground succeeded in saving the candelabra, the chalice and other holy vessels, and persons of a deeply devout bent of mind soon found in this an evidence of miraculous intervention.

“Though many ghouls had already prowled through the catacombs of the ruined city, St. Pierre presented a profitable field for the would-be looter. It would have been easy for any member of our party during the hours in which we tramped over the entombed town to have filled barrels with silver spoons, coins, earrings, finger rings, jewelry and knickknacks of all kinds, many of them of intrinsic value, and others of interest solely as souvenirs. In the ruins of every house of the better residential quarters might have been picked up scores of such trinkets. In one place it was easy to recognize the steel framework of a bicycle. In another the iron portions of a sewing machine projected through a conglomerate mass of dust, ashes, kitchen utensils and human bones.

STRANGE CONTRASTS

“Strange contrasts were presented at every pace during this grewsome journey. There were sugar mills and distilleries in which heavy machinery was crushed and pulverized so as to be hardly recognizable. Ponderous flywheels and cylinder heads were flattened out and shivered by some Titanic force. And yet, in one instance at least, in a house not a hundred yards from where such manifestations of power were visible, so fragile a thing as a tropical bird had been spared mutilation. Outside the balcony of one of the houses facing toward the sea a roomy wooden cage was suspended from either end by two wires. Its support at one end had been detached, but it hung securely from the other. The cage had not even been scorched. At its bottom, dead, but unburned and brilliant yet in the bright colors of its tropical plumage, lay a heron, doubtless the pet of some St. Pierre belle. Next door to the house where the bird in his feathered panoply had escaped the death blast a building fitted with great, thick oaken doors had been riddled as

though under the fire of a battery of rifled guns. The doors were blown from their hinges and great ragged openings yawned through their panels as though volleys of buckshot had been poured through them."

UNDER MONT PELEE'S BROW

Leaving Fort de France at one o'clock Monday morning, May 19, the *Luckenbach*—the *Herald* despatch boat—ran past St. Pierre and then under the brow of Pelee long before daylight. The volcano at that time was an awe-inspiring spectacle. Great clouds of fleecy vapor were rolling aloft, not only from the main crater, but from many other seams or vents that had been opened along its slopes. Some of these were well down toward the base. The moon was shining full and touching with silver the great columns of smoky vapor that rolled aloft in rings and spirals toward the zenith. Only from the mouth of the main crater was the fleecy mass reddened to an angry russet glow by the fiery furnace beneath.

As the *Luckenbach* skirted the shore, giving the volcano a wide berth of not less than four miles, the distant muttering of its thunder could be heard, and as the steamer's passengers and crew listened awe-stricken, the topmost crater belched again. Long tongues of fire shot up through the smoke, now black and lurid with ashes and dust. The heavens glowed red above old Pelee's crest, as they do when some gigantic conflagration at night writes its signal aloft where all may read it within a radius of miles. As the boat forged seaward the last glimpse of the fiery mouth of the demon that had wrought such havoc was a spectacle never to be forgotten.

CHAPTER XI.

Experiences on Barbados and St. Vincent.

A handwritten signature in dark ink, appearing to read "J. Russell". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

U. S. CONSUL AT BARBADOS

BARBADOS is situated in latitude $13^{\circ} 4'$ north, longitude $59^{\circ} 37'$ west. St. Vincent is about 96 miles west from Barbados; population about 47,000; Martinique is about 120 miles nearly north from Barbados; population 150,000 to 200,000.

ERUPTION OF MOUNT SOUFRIERE

Mount Soufriere, the volcano on St. Vincent, has been quiescent since April 30th, 1812, when a terrific eruption took place. The first indications of eruption from the mountain were noticed on the 5th and 6th of May, 1902, and the knowledge that Mount Pelee, on Martinique, was in eruption increased the apprehension of the people. From about 9 A. M. on Wednesday, the 7th, heavy thunderings were heard from the Soufriere, with continuous flashes of lightning, but no rain. This continued until 1.30 P. M., when it changed into a continuous and tremendous roar, and vast columns of smoke issued from the crater. These columns became denser, and at 2.40 P. M. scoria began to fall like hail, and then changed

into a fine dust. Lava destroyed the plantations nearest the mountain; large stones and gravel fell in great quantities during the day and succeeding night. The volcano roared all night, but during the next day, the 8th, the noise became intermittent, the scoria and dust still falling, but decreasing in quantity. These conditions continued intermittently until the 13th of May, when the volcano seemed to subside, though for many days later the mountain still smoked and showed signs of unrest.

CONDITIONS AT BARBADOS

The conditions at Barbados during this period were remarkable in many respects; everybody was discussing the possible consequences of the volcanic eruption at Martinique. About 2.30 P. M., May 8th, two loud reports were heard in quick succession, followed some minutes after by a third report. The sound was as if heavy guns were being fired near by. People began to gather near the harbor, expecting to see a man-of-war out at sea engaged in target practice with heavy guns. Such loud explosions, if not from artillery or explosions near by, were soon connected with the volcanic activity at St. Vincent, and this opinion was confirmed by the sudden appearance to the westward of a heavy black cloud. At 4 P. M. the cloud covered this island, at 4.30 fine sand and dust began to fall, striking like hail or wind-driven snow. At 5 P. M., more than an hour before sunset, it was as black as the darkest midnight. The dust fell all night, and covered the island to a depth variously estimated at from one to three-quarters of an inch. The dust was all-pervading; it was very fine, and reached the inside of watches and every minute crevice. Many suppose it has fertilizing qualities; at any rate, we shall be plagued by it for a long time to come. The scene was one to rouse the imagination and terrify many who

feared a tidal wave or earthquake ; as a fact, there was a phenomenal rise in the tide at Barbados during the afternoon of May 7th.

The result of this terrible disaster at St. Vincent is fully equal to all published reports. The people were dazed. The more active were straining every nerve to afford relief to the suffering. The loss of life is variously estimated at from 900 to 1,600. It is extremely probable that not less than 1,600 have perished. The condition of the injured was heart-rending indeed. The Executive of Barbados at first declined aid, but the distress was greater than he thought, and liberal aid has been sent by Barbados, British Guiana, St. Lucia and other near-by colonies. The details received early from the scene of disaster were most horrifying. Carcasses of beasts and human bodies were lying by the hundreds in a state of decomposition, and in small shops, opened three days after the eruption, 87 unrecognizable decaying bodies were discovered. Very many injured and sick were collected and are being cared for. Medical aid and medicines were early sent there. H. M. S. *Indefatigable* left Barbados May 15th for St. Vincent with food, medicines and other helps. It will be a long, sad time before St. Vincent recovers from this last awful visitation. The island was devastated by the hurricane of September, 1898, and the struggles of the people were hard indeed ; and now, when hope began to glow in their hearts, a still more awful calamity has fallen upon them. Besides the loss of life, and the physical agonies of the injured, there is to be considered the destruction of stock, crops, fruit and other property. While temporary aid will reach these people, it is pitiful, indeed, to think of what they must endure for a long time to come.

The following official communication was received from Mr. E. A. Richards, U. S. Consular Agent at St. Vincent :

U. S. CONSULAR AGENCY,
ST. VINCENT, W. I., May 16th, 1902.

S. A. MACALLISTER, ESQ.,

U. S. Consul, Barbados, W. I.

DEAR SIR:—In reply to your despatch of yesterday's date, I beg to state that, having called on the Governor with the view of obtaining the information asked for by you, he stated as follows:

"There have been 1,600 deaths, 160 wounded, 130 of whom are now in hospital (but it is feared many others will succumb), 9 or 10 plantations have been destroyed and almost 2,000 cattle killed. Estimated damage, £50,000 to £60,000. Food supplies will be wanted for six months to feed 4,000 or 5,000 persons left destitute, for whom houses will have to be erected. Immediate wants have been supplied, but help will be very acceptable."

I have given you the exact words of the Governor, and, so far as I can learn, his description may be taken as correct as it is possible at present to estimate.

I am, sir, your obedient servant,

(Signed) E. A. RICHARDS,
U. S. Consular Agent.

CHAPTER XII.

Experiences in Martinique during and after the Destruction of St. Pierre.



THE loss of life and the destruction at St. Vincent were terrible indeed, but what words can describe the awful facts and scenes at Martinique? A few days before the fateful 8th of May, 1902, there was a beautiful city in Martinique, called St. Pierre; a city of churches, convents, colleges, banks, warehouses, residences; by the last census it contained 35,000 human beings. At least 5,000 more lived in the near-by little towns and villages. In a few moments, on the morning of the 8th of May, 1902, the city of St. Pierre and most of its suburbs, with 30,000 human beings, had perished, as perished the cities and inhabitants of Pompeii and Herculaneum! No one on shore close enough to describe the realities of the storm of fire could live to give his story. Hundreds of incidents will be related, hundreds of opinions and theories will be expressed, but the narrative of the utter destruction of St. Pierre during the time of its occurrence will probably never be accurately written. It is said that only one of the thousands on land within the zone of that terrible deluge of fire is alive to-day!

St. Pierre is no more!!! The beautiful seaside city is now a blackened ruin, the swollen and bursted corpses of her people lie strewn along the deserted, obstructed streets, and amid the ashes of the burnt buildings.

But let the scene be described as witnessed by two of the gentlemen who composed a relief party sent from Barbados on the night of May 10th, arriving at Martinique on Sunday morning, May 11th, three days after that fearful morning. One is by Mr. Arthur J. Clare, the United States Vice Consul at Barbados, and the other is a report of Dr. Manning, who had charge of the relief party referred to.

THE VICE CONSUL'S REPORT

UNITED STATES CONSULATE,
BARBADOS, W. I., May 12th, 1902.

S. A. MACALLISTER,
U. S. Consul, Barbados.

SIR :—In accordance with your written instructions of the 10th instant, to proceed to Martinique and render any assistance in my power to Mr. Prentis, our Consul at St Pierre, his family, or any other Americans who might be sufferers from the disastrous volcanic eruption at St. Pierre on the 8th instant, I reported on board the *S. S. Solent* at 5.45 P. M. as instructed.

The *Solent* was to leave at 6 P. M., but on account of delay in taking supplies on board, sent by the Government of Barbados, we did not sail until 8.05 P. M., arriving at Fort de France, Martinique, at 7 o'clock the following morning.

The Colonial Secretary of Barbados, who was in charge of the relief expedition from this island, and Dr. Manning, in charge of the medical staff, went on shore, at the invitation of the Port Officer at Fort de France, to confer with the Acting Governor of Martinique

and to arrange about landing the supplies. It was decided that we should at once sail for St. Pierre and discharge the supplies at Port de France on our return to that port in the evening.

We arrived at St. Pierre about noon, and a landing party was at once got together, consisting of Hon. T. J. Newton, Colonial Secretary, and his clerk, Mr. Allder; Doctors Manning and Hutson, of Barbados; Dr. W. E. Aughinbaugh and T. J. Ryan, Americans, who were the first to volunteer for the relief expedition; the ship's doctor; N. E. Parravicino, the Italian Consul at this place, who had joined us at Fort de France; Mr. Bowring, representing the Quebec S. S. Co.; Mr. Shennery, assistant editor of the "Barbados Advocate;" several other gentlemen and myself. The captain of the *Solent* was in command of the landing party.

From the ship we could plainly see that the city of St. Pierre was entirely destroyed, but it remained for us to land to realize the full horror of the situation. No life whatever was to be seen—no animals, birds, insects, nothing but dead bodies lying along the water front and in all the streets through which we passed. The clock at the Military Hospital had stopped at 7.50, the hour of the terrible volcanic eruption which destroyed a city and its 35,000 inhabitants, no one within the city or suburbs escaping on that fateful morning.

The city was still on fire in several places when we landed, and the scent of the burning bodies, and that from the other bodies which had been exposed to the sun for several days, was horrible. The building in which the American Consulate was located is entirely wrecked, only part of the walls remaining; no papers, books, or anything whatever connected with the Consulate could be found, all having been destroyed by fire. Without doubt Consul Prentis, his wife and daughters have perished. Mr.

Testart, the American Vice Consul, was boarding the S. S. *Roddam* at the time of the explosion, and was thrown into the sea by the concussion and drowned.

On our way back to the water front, I met Consul Ayme, of Guadeloupe, who had come over from that place in a chartered steamer. Mr. Ayme returned to Fort de France in the *Solent* with our party, and decided to remain there and communicate with Washington regarding his visit to St. Pierre.

As all the food stored in warehouses in St. Pierre was destroyed, a large supply will be needed at Fort de France for some time to come, to enable the Government to feed the refugees daily pouring into that place. The *Solent* discharged the supplies at Fort de France, which were sent by the Government of this island, and we left there about 6 P. M. on the 11th and arrived at Barbados the following morning at 9 o'clock.

Respectfully

(Signed) ARTHUR J. CLARE,
U. S. Vice Consul.

THE DESTRUCTION OF ST. PIERRE.

(BY DR. C. J. MANNING OF BARBADOS.)

On Saturday last telegrams were received stating that there had been terrible loss of life in Martinique, but beyond the bare fact that the loss of life to town and shipping had been great, there was nothing definite, nothing certain. The first and natural impulse was to render assistance to our sister colony, and at half-past one o'clock the Governor summoned his chief officers, and the result of their deliberation was that assistance should be sent and the sooner the better. It was also decided that the assistance should be twofold. First, a quantity of foodstuffs should be at

once dispatched ; second, medical relief should also be sent, as it appeared most probable that there would be a vast number who had escaped from St. Pierre, badly burnt or injured during the destruction of the town.

Accordingly Dr. Manning was ordered to take charge of this department, and with the assistance which was freely given on all sides, the services of five medical men—including Dr. Manning—were secured, viz.: Surgeon-Majors Will and Bent from the garrison, Dr. John Hutson and Dr. Aughinbaugh. Three Hospital nurses also volunteered their services. The Sanitary Board very liberally offered the loan of fifty cots with blankets and clothing. The garrison also sent a party of ambulance bearers with stretchers and two large tents. The General Hospital furnished instruments and surgical appliances, and drugs were procured in town so as to form a complete outfit for fifty beds. The Royal Mail generously placed the *Solent* at our disposal, and the whole outfit was got on board on Saturday evening, the ship steaming out of the harbor on her mission of mercy at 8 o'clock.

THE "SOLENT" AT ST. PIERRE

Fort de France was reached at 7 A. M., and Mr. Newton, the Colonial Secretary, who was in charge of the party, landed and presented his papers to the Acting Governor, who readily gave permission to allow the *Solent* to go to St. Pierre, which was reached about noon. A boat's party was landed, and on nearing the shore the remains of nine vessels were seen besides the *Roraima*, which was still burning. She was laden with kerosene oil and had blown up, and it was observed on passing her that a wicker-work chair had been blown from the deck and had hooked on to one of the awning stanchions. The sides of the ship were red hot, for as the

waves lapped her sides we could hear them hiss and see the smoke. The absolute ruin of the town next attracted our attention; the bare walls were standing, it is true, but heaps of debris blocked the streets everywhere and made it exceedingly difficult to walk. On landing we found all the large fig trees near the beach uprooted, and some of them, with the roots uppermost, were without a single leaf left on them. The boughs were snapped rudely off and scattered all over the landing place.

We observed that one house had fallen in and the ceiling laths were twisted all in one direction, just as one might twist a handful of straws. These seem to point to the fact that the sudden escape of so much heated air from the volcano at the time of the great explosion had caused a sort of whirlwind which tore up the trees by their roots. There was no sign whatever of there having been a great earthquake, as there were no cracks or fissures on the esplanade, or anywhere else, and as a matter of fact nearly all the walls, or, at all events, the greater part of them, were left standing. Smoke and flame were to be seen in various parts of the town, and far above our heads the volcano could still be seen sending out dense masses of black smoke. The cathedral was yet smouldering, and here and there we passed houses still aglow and smoking. And now began our excursion through the town. No words can depict that scene.

DISTRESSING SPECTACLES

I must not omit to mention that as soon as the ship dropped anchor we noticed the unmistakable smell of scorched flesh, and as we approached in the boat the smell increased perceptibly, and at times in our journey through the town became quite overpowering. Wherever we turned there were dead bodies to be seen, scorched, blackened, hideous and heart-rending to behold. The greater

number of them were on their faces, some with their heads buried between their hands as if to avoid the stifling effects of the vapor which suffocated them all. Here lay a magnificent specimen of a man, evidently a sailor who had perhaps floated ashore on some piece of wreckage in the full assurance that he had escaped the dangers of the burning ship and was safe. He had pulled his jumper over his head to avoid the suffocating fumes, but all to no purpose. Not one living soul had escaped. The city was doomed, and no one survived to tell the awful tale of its destruction. Turning from this poor fellow we pass on to find more and more dead bodies. Round this corner are sixteen in a heap, all evidently having been running their fastest to escape death, which overtook them in the twinkling of an eye. There they lie a seething, sickening mass of scorched and putrifying flesh. Look at the dainty little shoes still on the feet of this slender girl! Beyond her there lie two, evidently mother and daughter; the child is still grasping tightly the mother's hand, now locked fast in death. From another we take the small piece of bread, with the mark of the little one's teeth freshly impressed upon it, the very last morsel that she would ever taste.

We pass on along the street, and opposite the bank there lie the remains of probably the horse and buggy of Mr. Barnes, the manager of that institution. The horse had his head tucked under him in his effort to escape the effect of the deadly fumes. Ugh! what was that my foot sank into?—a dead body covered with debris. Let us move on. It matters not, wherever we turned, wherever we roamed, there was the same awful story of death and destruction. Look at that poor girl! She must be about eighteen. There is a splinter of wood driven clean through her leg. Here lie the charred remains of a dog. Look at this poor woman!

How bravely she has fought for the little child she has clasped to her breast ! She lies right over it, but what avail ? Both are dead.

But oh, the heat, the dust, and the terrible depression which overpowers one. Just think of it. On Wednesday last here was a busy town full of bustle and business, and now a ruin, with not a living creature left in it. From what we could gather it appears that the mountain, for days before the terrible explosion which destroyed the city, had been uneasy ; rumbling noises were heard ; smoke and flashes of light had been seen ; but there was no alarm. But, at all events, people were evidently beginning to be uneasy, and the Governor of Martinique took with him his wife, and a commission of "savants" was held on the condition of affairs to see if there was any danger. They confidently told the people there was no cause for alarm, and, as a proof, the Governor and his lady moved about the streets of St. Pierre to reassure the inhabitants, who were evidently becoming alarmed ; but commissions of enquiry on volcanoes seem to be productive of no more good than commissions on anything else.

THE TERRIFIC EXPLOSION

There is a report afloat, but I trust that this might not be true, viz., that a cordon of soldiers was placed round the town to hinder persons from escaping and to prevent panic ; but in the meantime, about 8 A. M.—for the clock in the bank which we found, and that at the top of one of the streets, both stopped at ten minutes to 8 o'clock—a terrific explosion from the volcano occurred, covering the shipping and the town not with lava, as we see it at Vesuvius, but with stones and other material so awfully hot that whatever they touched took fire if at all inflammable. This molten material covered the town and the harbor so that all the

shipping and every building in the town must have been ablaze at about the same time. Simultaneously there came the blast or whirlwind of hot air, which tore up the trees by their roots and no doubt damaged the buildings also.

Barbados, too, has contributed to the number of the victims. For Mr. Parravicino lost his little daughter. She was to come up by the *Roraima*, and it is possible she was on board ship at the time of the disaster. [The story of the search for her body is given elsewhere.] The wife of Mr. H. J. Ince and child have also perished on that ship. Some members of Mr. Stokes' family were also on board. Mr. Gloumeau, the bandmaster of our Police Band, lost all his family, some thirty all told—mother, sisters and other relatives all gone in one of the most fearful convulsions of nature the world has ever seen.

The chaplain of the S. S. *Caribbee*, which arrived here yesterday afternoon, informed me that he observed, when passing Martinique on Sunday night, that Pelee was still active; flashes of light were to be seen and volumes of dense smoke were issuing forth. He also passed by much wreckage and many dead bodies during the afternoon.

We offer those who are left to lament their loss our most heartfelt and sincere sympathy.

DESTRUCTION OF THE STEAMSHIP "RORAIMA"

The S. S. *Roraima*, of the Quebec S. S. Co., was at anchor at St. Pierre on the fateful morning of May 8th. The officers, crew and passengers numbered about sixty. All but ten perished. Eight of these are in the hospital at Fort de France, badly burned. The chief officer, Mr. Scott, and the assistant purser, Thompson, were rescued by the French cruiser *Suchet*. Here is their story of the catastrophe; I use their own words:—

[It is proper to state here that the stories of the experience of Messrs. Scott and Thompson have already been given. But as the accounts cited by Dr. Manning differ in language from those mentioned, and contain new and important facts from the observations of these eye-witnesses we quote what he says as an essential part of his highly interesting report.]

Mr. Scott states that "the ship arrived at St. Pierre at 6 A.M. on the 8th. About 8 o'clock loud rumbling noises were heard from the mountain overlooking the town, eruption taking place immediately, raining fire and ashes; lava running down the mountain side with terrific roar, and sweeping trees and everything in its course. I went at once to the fore-castle-head to heave anchor. Soon after reaching there there came a terrible downpour of fire, like hot lead, falling over the ship and followed immediately by a terrific wave which struck the ship on the port side, keeling her to starboard, flooding ship, fore and aft, sweeping away both masts, funnel-backs and everything at once. I covered myself with a ventilator standing near by, from which I was pulled out by some of the stevedores, and dragged to the steerage apartment forward, remaining there some time, during which several dead bodies fell over and covered me. I was extricated by some men. Shortly after, a downfall of red hot stones and mud, accompanied by total darkness, covered the ship. So soon as the downfall subsided, I tried to assist those lying about the deck injured, some fearfully burnt. Captain Muggah came to me, scorched beyond recognition. He had ordered the only boat left to be lowered; but, being badly damaged, could not be lowered from the davits. From that time, I saw nothing of the captain; but was told by a man that the captain was seen by him to jump overboard. The man followed him in the water, and succeeded in getting the captain on a raft

floating nearby, where he died shortly after. I gave all help possible to passengers and others lying about the deck in dying condition, most of whom complained of burning in the stomach. I picked up one little girl lying in the passageway dying, covered her over with a cloth, and took her to a bench nearby, where I believe she died. Sometime after, a man who had been in the water with a life buoy on, told me the captain was dead. About 3 p. m. a French man-of-war's boat came alongside and passed over the side about twenty persons, mostly injured, and myself and other survivors were taken to Fort de France. When I was on the forecastle-head I observed a steamer to the north, but further out to sea than the *Roraima*. I afterwards saw the *Roddam* steaming out to sea, with her stern part on fire. The *Roraima* caught fire and was burning when I left her in the afternoon, the town and all shipping destroyed."

WHAT THOMPSON SAW

Assistant Purser Thompson said he was on the deck of *Roraima* about 7 a. m., and saw the volcano emitting smoke and flame, rising from the crater. The chief steward called the passengers on deck to witness the lava which began to sag down the mouth of the mountain, running in the direction of the Usine Guerrin. The smoke became more dense and slight darkness apparent. The gloom began to increase, and he then suggested to the steward to get under cover, as the situation was getting terrible. He then saw the flames darting upward from the mountain to a great height in the air, and, at the same time, heard awful subterranean sounds such as had never been heard by man before, and which he hoped never to hear again. They were louder than the sound of any cannon. The mountain appeared to be rent in pieces, and he saw a living ball of fire, large enough to cover the whole of

St. Pierre, rolling down upon the city. He rushed into his cabin, locked it, and threw a blanket over his head, shutting the port-hole as well. The fire by this time had struck the water's edge, and great foam arose; the water swelled to a great height and fell on the ship, keeling her over. He remained some time in his cabin, but came out, after the water had subsided, to look around. The sight which met his gaze was awful. People were lying all about the deck dead, and there were many others dying and suffering. The captain jumped overboard, his face in a terribly scalded condition. Cooper, his servant, jumped after him, and they drifted about the harbor. Finding he was getting too near the shore, and that the captain could not live, Cooper decided to leave him. He returned to the ship to get help, but when he reached the raft the second time the captain was dead.

THE "RODDAM" ESCAPES

The British steamship *Roddam* had a wonderful escape. She had just entered the harbor and was about nine miles distant from the crater when the terrible eruption occurred. The storm of fire and cinders fell on her and with great difficulty she steamed away, but about twenty of her crew perished. The captain and the other survivors, though badly burned, managed to get the ship to the Island of St. Lucia, where they were sent to the hospital. At St. Lucia new officers and crew were obtained, who brought the ship to Barbados on the 17th instant. She is now at anchor here, showing the results of her fiery ordeal.

The prompt and generous aid afforded at a most opportune time by Barbados, British Guiana, Trinidad, St. Lucia and other neighboring islands to both St. Vincent and Martinique will always command the highest praise and commendation; more especially so as the people of those places are for the most part very poor



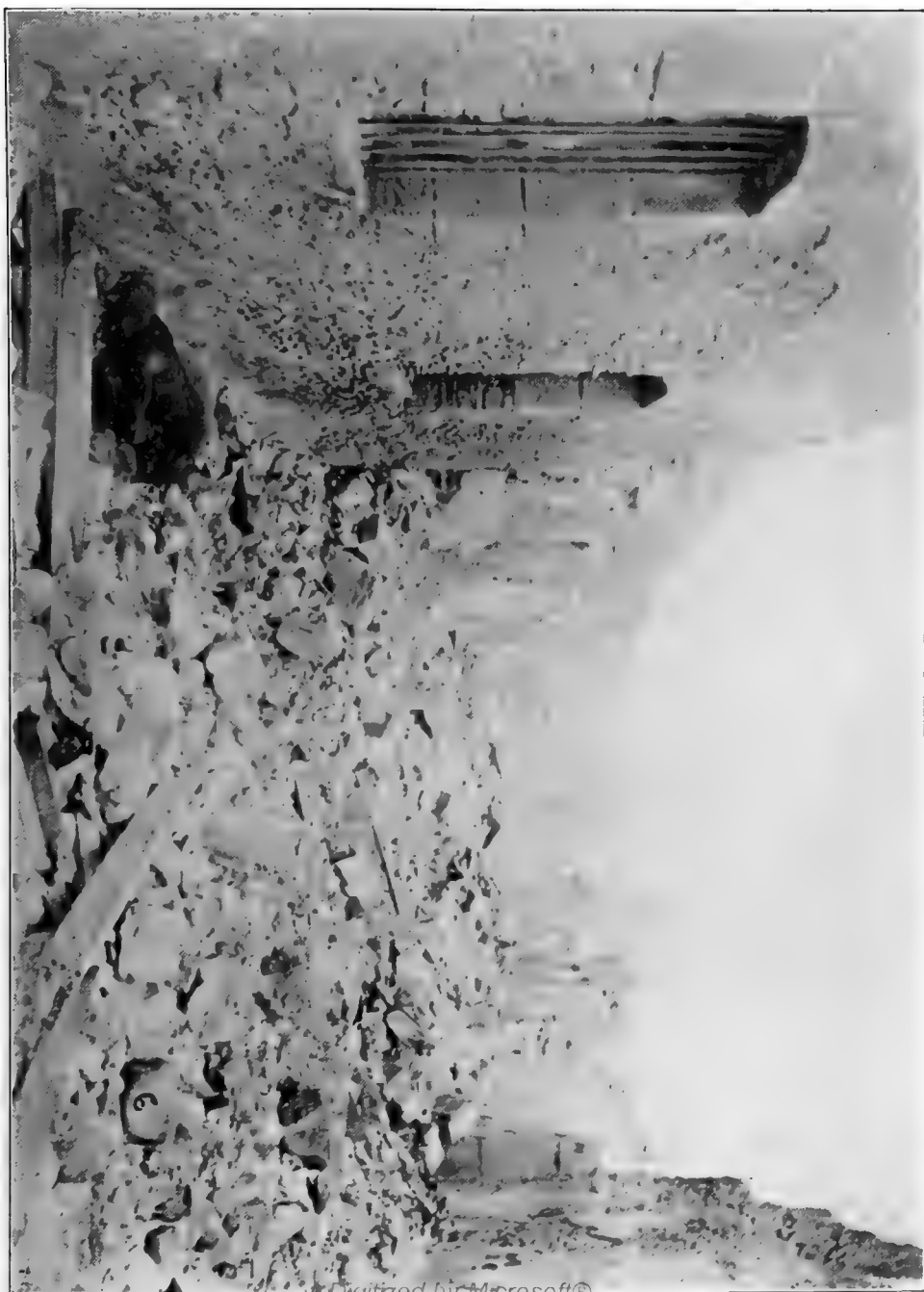
(Copyrighted by Judge Publishing Co., 1902.)
THE ONLY PHOTOGRAPH TAKEN OF THE VOLCANIC OUTBREAK OF MT. PELEE, MAY 8,
1902, DURING THE HEIGHT OF THE ERUPTION, A SCENE AS GRAND AS IT
WAS APPALLING.



(Copyrighted by Judge Publishing Co., 1902.)

**A PHOTOGRAPHIC PICTURE GIVING GENERAL VIEW OF RUINS OF ST. PIERRE LOOKING
TOWARD THE MOUNTAIN.**

Digitized by Microsoft®





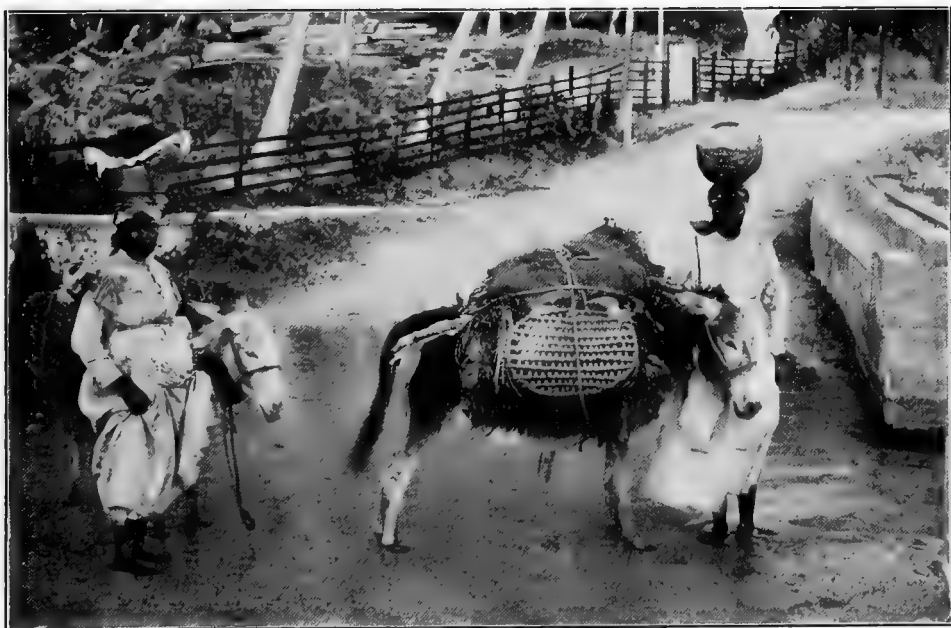
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THE CLOCK THAT TOLD THE STORY.

This Picture Shows the Ruins of the Hospital of St. Francis and the Clock with the Hands Pointing to 7.50, which Indicated the Time at which the City was Overwhelmed.



THE COCOA INDUSTRY, WEST INDIES



A FAMILIAR ROAD-SIDE SCENE.—Going to Market

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GIANT FERNS OF THE ISLAND OF MARTINIQUE



THE BAY OF NAPLES AND MT. VESUVIUS IN DISTANCE.



FOUNTAIN STREET SCENE

themselves, and, owing to the low price of sugar, their principal staple, there has been and still is very great depression and anxiety. Their aid has been extended in a most splendid manner, at great sacrifice to themselves, and in a quiet, sorrowful and unostentatious spirit.

Cable communication between St. Vincent and Martinique was interrupted on May 7th. Messages had to be sent by vessels from St. Vincent to Dominica for transmission to other parts of the world. This made cable communications very slow and expensive. On May 20th the cable had not been repaired. Communication from Dominica north was not disturbed.

CHAPTER XIII.

The Guatemalan Earthquakes and the Nicaragua Canal.

THE volcanic eruption is an occurrence of dread uncertainty. Now it comes upon us "like a thief in the night," with hardly a moment's warning of its ruinous intent; now it sends its premonitions in advance, giving notice of the approaching outbreak for months, sometimes for years. But the alarm signal of its coming is at times more fatal than the work of the volcano itself, for this is the earthquake, that most destructive to human life of all earth's agents of terror. We have seen that the explosion of 1812 was heralded by earthquake shocks two years in advance, culminating in the frightful disaster at Caracas. That of 1902 sent similar destructive tidings of its approach, coming from as far away as the states of Guatemala and Mexico.

SUBTERRANEAN FORCES

In truth an outbreak like that of the Martinique volcano could not but indicate some deep-seated and far-reaching condition of unrest in the earth's crust. The forces at work in this disaster lay many miles below the earth's surface, and were in consequence capable of making themselves felt throughout an area continental in extent. Whether the final explosion was due to pressure from above, to rock-splitting and fissuring, to the generation of steam or other cause, its conditions existed long before the final outbreak,

the pent-up forces of the rocks causing the surface to tremble violently more than a thousand miles away.

The earthquake's action, traveling through the rock strata below, probably produces its most energetic surface effect at some point where the crust is weak and the resistance slight. In the present instance that point appears to have been in Southern Mexico and Western Guatemala, where severe disturbances of the earth preceded the eruption of Mont Pelee. The first warning came on the 16th of January, 1902, in a destructive earthquake in the south of Mexico, its centre of catastrophe being at Chilpancingo, the capital of the state of Guerrero. This city was violently shaken, hundreds of its people being killed and many more injured by falling walls. The greatest loss took place in the parish church, the walls of which were thrown down on a crowd of worshippers who had assembled there. But the shock was felt over a large area, and the vibration of strong buildings caused much alarm in the distant city of Mexico.

THE CONVULSION OF APRIL 18, 1902

Far more disastrous were the convulsions which visited Guatemala on April 18, and for nearly a week shook the cities, towns and villages on the western slope of the sierras of that republic. Shortly after 8 o'clock on the night of April 18, at Guatemala City, the capital of the republic, a blinding flash of lightning, followed by a thunder storm and torrents of rain, all in the space of a very few minutes, caused the people in the streets to rush to the houses for shelter. In an instant, however, an earthquake was upon them.

The shock lasted from thirty to forty seconds and caused the wildest panic. Rushing frantically into the darkness and through the flooded streets, anywhere away from the straining rafters and cracking walls, ran the multitude crying, praying, and a few trying

to sing the "Salve Regina." The shocks following were less severe, and by 10 o'clock many of the inhabitants were wandering about, examining the walls of the Cathedral of Santa Teresa, La Recollection and other churches which were damaged. There was no loss of life, and the property damage was less than at first feared, though walls were cracked all over the city and many old houses were tumbled in ruins. In the days that followed the shocks continued with more or less violence.

This earthquake was by no means confined to the city named, but extended through the whole northwestern region of that country, one of the richest districts in Central America, and left ruin everywhere in its track. The buildings and machinery of the rich coffee and sugar estates were ruined. As news came in from the hill country the tale of destruction spread rapidly and grew appalling. Among the towns that felt its force were Amatitlan, San Juan, San Marcos, Escuintla, Santa Lucia, Utatlan and several smaller places, all these being partly ruined, though few lives were lost.

A CITY IN RUINS

The centre of calamity was at Quezaltenango, a place of more than 40,000 inhabitants and the second city of the republic, which suffered by far the most. Here hundreds of residences and public buildings were either totally destroyed or seriously damaged. It is estimated that more than 90 per cent. of the buildings fell. The very narrow streets, often not over three or four yards wide, and the irregular manner in which the town was built, served to make deathtraps of the houses, so that not less than 2,000 people were killed and many persons were badly injured. Fire as well as flood added to the horror of the night of ruin, with the result that many people went insane and some committed suicide.

At the time of the first shock a violent wind- and rain-storm was raging. The electric lighting plant of the city was disabled, and when the people, panic-stricken by the rumbling and shaking of the earthquake, rushed from their houses it was only to meet death. Stumbling and falling in the narrow, winding streets, in total darkness save when the lightning lit up the crumbling city with an unearthly glare, the people died by hundreds under the falling walls, while other hundreds were caught like rats, only to die of suffocation or drowning. The quaking and rain kept up continually for three days. This made it almost impossible to do effective relief work, and as a consequence the stench from the thousands of bodies in the ruins became unbearable. To prevent the threatened ravages of pestilence the Government was compelled to employ large numbers of men to remove the bodies from the wreck and consign them to the grave.

Natives from the interior flocked to the capital, completely terror-stricken. Farms were deserted, and there were fears of a famine in consequence. The Pacific coast suffered far greater damage than the Atlantic, and the disturbance of the surface extended into Nicaragua, doing there also much damage to property. At the time of the earthquake a session of the National Commission for the Louisiana Purchase Exposition was being held, and the members, with a composure remarkably in contrast with the blind terror of the populace, continued their sitting for two hours, though the earthquake shocks made the large crystal chandelier of the palace swing like a pendulum over their heads.

In addition to these preliminary phenomena, the eruption of Pelee was attended with other evidences of far-reaching disturbance. Earthquake tremors were wanting, the seismic instruments in various places showing no evidence of disturbance. But a

magnetic influence spread wide, the delicate magnetic needles of the Coast and Geodetic Survey in Maryland and Kansas being distinctly affected and their disturbance lasting for many hours. Other indications of the earth's convulsive affection were threats of an eruption in the volcano of Colima, Mexico, which had been in a state of unrest for ten years, and slighter evidences of internal activity in other places.

The facts here detailed, and in particular those of the earthquake disturbances in Mexico and Central America, are of great significance in connection with the measure now before Congress providing for the construction of an international ship-canal across Nicaragua, to connect the waters of the Atlantic and Pacific Oceans by a waterway traversing the neck of land which connects the twin American continents.

THE CANAL ROUTE

Without going into detail concerning the history of this project, we may say that it has been for many years, even for centuries, entertained, the Spaniards having dreams of such a canal more than three centuries ago. During the eighteenth century many plans for its construction were proposed, and actual work began. Money enough was expended on the French canal at Panama to more than complete it, but for the wild waste of funds, and some work was done on a parallel canal across Nicaragua. At the end of the century these projects had been virtually abandoned—though some work was still doing on the Panama Canal—and the United States government was entertaining the purpose of excavating a canal as a national enterprise.

A commission was sent to Central America and the Isthmus to investigate and report, and after a year or more of research gave its decision in favor of the Nicaraguan route as, all things considered,

the most promising. Bills were introduced into both Houses of Congress for the construction of a canal in accordance with the recommendation of the Commissioners, and were passed in two successive sessions of the House, though no final action was taken in the Senate. In January, 1902, the affair took a different aspect, due to an offer of the French Canal Company to sell their partly completed canal at Panama for \$40,000,000. This reduced the estimated cost of finishing the latter canal below that necessary for the Nicaragua route, and a decision was now rendered by the Commissioners in favor of the Panama project. Thus the matter rested in the spring of 1902. The final route of the canal was left clouded in doubt.

Meanwhile voices had been heard assailing the Nicaraguan project from another point of view, that of the volcanic character of the region it would traverse and its possible ruin by earthquake shock when completed. Prominent among those holding this view was Professor Angelo Heilprin, a geologist of Philadelphia, who published a number of treatises calling attention to the strong probability of such an occurrence. Panama, on the contrary, was considered practically safe, its past history showing a long freedom from seismic disturbance.

Earthquake shocks may, it is true, occur anywhere, and very destructive tremors have been experienced in regions absolutely non-volcanic. Yet the paroxysms of nature which change the features of a whole country, heave up mountains where there formerly were depressions, and make the ocean flow over what once was dry land, always take place in regions of crustal weakness. Such regions are marked by volcanoes, active or seemingly extinct. To locate a great work intended to last for all time across one of the "fire circles" of seismologists would be more a crime than a blunder.

Of these "fire circles" tropical North America contains two—one being indicated by the semicircular chain of volcanic islands in the West Indies, the other running approximately parallel to the latter from Central Mexico through Guatemala, Honduras and Nicaragua into Costa Rica. On the latter circle there are distributed over a linear distance of a little over 200 miles not less than twenty-five volcanoes. Some of these are inactive, but dormant volcanoes have a habit of suddenly bursting out with titanic violence, a fact of which we have had striking recent experience.

There are three volcanoes in Lake Nicaragua itself, which body of water it is proposed to make the summit level of the projected canal on this line. Indeed, the evidence of geology is that Lake Nicaragua was once an arm of the Pacific, and that the central plateau of Nicaragua was formerly much nearer to the Caribbean coast than at present. The forces which effected so vast a change in the configuration of the land are still active. The eruption in 1835 of Coseguina, which lies but sixty miles from the proposed Nicaragua canal route, was of extraordinary violence. So tremendous was this explosion, and so great was the storm of dust and ashes, that absolute darkness prevailed for thirty-five miles in every direction, while the rain of dust and ashes actually fell over a radius some 270 miles in diameter. Nearly twenty-five miles from the volcano the ground was covered with ten feet of ashes and fine dust. Seven hundred miles away, in the harbor of Kingston, Jamaica, the ejected materials fell four days after the explosion. The eruption was accompanied by detonations the roar of which was heard a thousand miles away, and it has been computed that the matter thrown out by the volcano during every six minutes of its forty-four hours of activity would have equaled in cubic contents the quantity of earth to be excavated in the construction of the projected

canal of Nicaragua. Coseguina could have filled up ten times in one hour a canal prism which the contractors, with all their boasted labor-saving devices and the employment of tens of thousands of hands, would require eight years to excavate.

Another active volcano, with its last eruption as recent as 1883, dominates the island in Lake Nicaragua which every ship will skirt on the passage from Greytown to Brito. This is Mount Ometepe. On the same island is a second volcanic peak, that of Madera. In 1844, nine years after the explosion of Coseguina, occurred the great earthquake which destroyed the city of Rivas, near the Pacific shore, and wrought great damage even at Greytown, a hundred and fifty miles away on the Atlantic side. The line surveyed for the Nicaragua canal between the lake and Brito runs only five miles from Rivas and has its Atlantic terminus at Greytown.

PANAMA EARTHQUAKES

The danger of such convulsions at Panama is far less. We are told by M. Bunau-Varilla, a distinguished French engineer, that in Panama there is within a distance of one hundred and eighty miles from the canal no volcano, even extinct. The Isthmus there, since its formation in the early quarternary period, before man appeared on the earth, has not been modified. It lies in an "angle of stability," so called by seismographers. Except for rare and not very violent seismic vibrations, originating at distant centres, the Isthmus of Panama has never been affected by volcanic disturbances. One earthquake of some violence, indeed, has occurred there during the historic period, that of 1621, when the greater part of Panama city was shaken down. Aside from this the most destructive earthquake known in the history of Panama was that of September 7, 1882. It lasted only a minute, but in that time

shook down the court-house and ruined the front of the old cathedral. Yet it may be affirmed that no paroxysmal convulsions have remodeled the geographical features of the Isthmus, as is the case with Nicaragua, and that its hills are nearly if not quite as stable as those of the Appalachian system.

We have spoken of these facts, not alone from their former bearing upon the canal question, but especially from their pressing importance in the light of recent events. In truth, little attention had been or seemed likely to be paid to them by legislators until after the startling event of May 8, 1902. This put a different aspect on the case, and aroused the people and press of the United States to a peril threatening the canal, if constructed in Nicaragua, of which few had been aware. Such an explosion as that of Mont Pelee was certainly an awakening incident. The Mexican and Guatemalan earthquakes showed that the forces of eruption were not confined to the volcanic chain of the Antilles, but were active in a region closely adjoining the projected canal, and that there was no security that earthquake shock or volcanic explosion might not take place at any time on the line or in the immediate vicinity of the canal, letting its water escape through fissures or burying the nearly \$200,000,000 of United States money expended in its construction under such tons of volcanic lava and ashes as have buried from sight the city of St. Pierre. Certainly, in view of these facts, Congress will feel it necessary to go slowly, and Panama Canal stock is likely to rise rapidly in public estimation as compared with that of its Nicaraguan rival.

We have spoken of Professor Heilprin as one who has frequently pointed out the danger here considered. We cannot better close this chapter than by a quotation from his latest views on the subject, written since the Martinique disaster. He says:—

"In various papers that I have recently published on the subject of the Nicaraguan Canal, I have indicated my dissent from the opinions expressed by the official geologists associated with that enterprise, which have maintained that the volcanoes in the regions to be traversed by the canal are in a decaying or semi-somnolent or extinct condition, and that consequently little is to be feared for a construction of the magnitude or character represented by the Nicaraguan Canal. No facts that are in possession of the geologists can be properly construed to support this conclusion.

PROFESSOR HEILPRIN'S VIEWS ON THE CANAL

"On the other hand, it may be said that all point conclusively in a direction which is directly the reverse of that which has been maintained. On the line of the proposed Nicaraguan Canal there are both active and semi-active volcanoes, even within the basin of Lake Nicaragua itself, and no knowledge which the geologist possesses can permit him in any way to indicate the possibilities of eruption which lie in these scenes of disturbance. At no great distance from the route planned, that is to say, in the volcano of Coseguina, as late as 1835 occurred one of the most paroxysmal of destructive eruptions that have ever been recorded, the volcano itself being almost exactly of the dimensions of Mont Pelee in Martinique. It must therefore be considered as a menace to any structure that may be built by man.

"A remarkable parallel can be drawn between the conditions prevailing in Nicaragua along the line of the proposed canal and those existing in New Zealand in the lake region of Rotomahana, in June, 1886, prior to the eruption of the great volcano Tarawera. At that time the volcano had been assumed to be extinct for upward of one hundred years, when entirely without

warning it broke out in full activity, rent the earth with a chasm forty miles long, drained the lake entirely of its waters, and destroyed the famous pink and white terraces. Precisely the same things may take place in the Nicaraguan region. The conditions are almost entirely identical, with this emphasis : That the Nicaraguan region, as a near neighbor of the Carribbean, probably occupies an area of still less stability than that of New Zealand.

“So far as the Panama region is concerned, it has powerfully in its favor the fact that there are no volcanoes either on the route or near the route, and that even the seismic disturbances which are so common throughout South America, Central America and a large part of Mexico have been comparatively little felt in that region for a period of very nearly three hundred years—no destructive eruption or earthquake having taken place there since 1621.”

In view of these considerations one would reasonably conclude that the Panama route was far the safer of the two. This, however, is not for the laity to decide, but must be left to the assembled wisdom of our Congressional representatives.

CHAPTER XIV.

The Active Volcanoes of the Earth.

IT is not by any means an easy task to frame an estimate of the number of volcanoes in the world. Volcanoes vary greatly in their dimensions, from vast mountain masses, rising to a height of nearly 25,000 feet above sea-level, to mere molehills. They likewise exhibit every possible stage of development and decay: while some are in a state of chronic active eruption, others are reduced to the condition of *solfataras*, or vents emitting acid vapors, and others again have fallen into a more or less complete state of ruin through the action of denuding forces.

NUMBER OF ACTIVE VOLCANOES

Even if we confine our attention to the larger volcanoes, which merit the name of mountains, and such of these as we have reason to believe to be in a still active condition, our difficulties will be diminished, but not by any means removed. Volcanoes may sink into a dormant condition that at times endures for hundreds or even thousands of years, and then burst forth into a state of renewed activity; and it is quite impossible, in many cases, to distinguish between the conditions of dormancy and extinction.

We shall, however, probably be within the limits of truth in stating that the number of great habitual volcanic vents upon the globe which we have reason to believe are still in active condition, is somewhere between 300 and 350. Most of these are marked by more or less considerable mountains, composed of the materials

ejected from them. But if we include mountains which exhibit the external conical form, crater-like hollows, and other features of volcanoes, yet concerning the activity of which we have no record or tradition, the number will fall little, if anything, short of 1,000.

The mountains composed of volcanic materials, but which have lost through denudation the external form of volcanoes, are still more numerous, and the smaller temporary openings which are usually subordinate to the habitual vents that have been active during the periods covered by history and tradition, must be numbered by thousands. There are still feebler manifestations of the volcanic forces—such as steam-jets, geysers, thermal and mineral waters, spouting saline and muddy springs, and mud volcanoes—that may be reckoned by millions. It is not improbable that these less powerful manifestations of the volcanic forces to a great extent make up in number what they want in individual energy; and the relief which they afford to the imprisoned activities within the earth's crust may be almost equal to that which results from the occasional outbursts at the great habitual volcanic vents.

In taking a general survey of the volcanic phenomena of the globe, no facts come out more strikingly than that of the very unequal distribution, both of the great volcanoes, and of the minor exhibitions of subterranean energy.

Thus, on the whole of the continent of Europe, there is but one habitual volcanic vent—that of Vesuvius—and this is situated upon the shores of the Mediterranean. In the islands of that sea, however, there are no less than six volcanoes: namely, Stromboli, and Vulcano, in the Lipari Islands; Etna, in Sicily; Graham's Isle, a submarine volcano, off the Sicilian coast; and Santorin and Nisyros, in the Ægean Sea.

The African continent is at present known to contain about ten active volcanoes—four on the west coast, and six on the east coast, while about ten other active volcanoes occur on islands close to the African coasts. On the continent of Asia, more than twenty active volcanoes are known or believed to exist, but no less than twelve of these are situated in the peninsula of Kamchatka. No volcanoes are known to exist in the Australian continent.

The American continent contains a greater number of volcanoes than the continents of the Old World. There are twenty in North America, twenty-five in Central America, and thirty-seven in South America. Thus, taken altogether, there are about one hundred and seventeen volcanoes situated on the great continental lands of the globe, while nearly twice as many occur upon the islands scattered over the various oceans.

ASIATIC INLAND VOLCANOES

Upon examining further into the distribution of the continental volcanoes, another very interesting fact presents itself. The volcanoes are in almost every instance situated either close to the coasts of the continent, or at no great distance from them. There are, indeed, only two exceptions to this rule. In the great and almost wholly unexplored table-land lying between Siberia and Tibet four volcanoes are said to exist, and in the Chinese province of Manchuria several others. More reliable information is, however, needed concerning these volcanoes.

It is a remarkable circumstance that all the oceanic islands which are not coral-reefs are composed of volcanic rocks; and many of these oceanic islands, as well as others lying near the shores of the continents, contain active volcanoes.

Through the midst of the Atlantic Ocean runs a ridge, which, by the soundings of the various exploring vessels sent out in recent

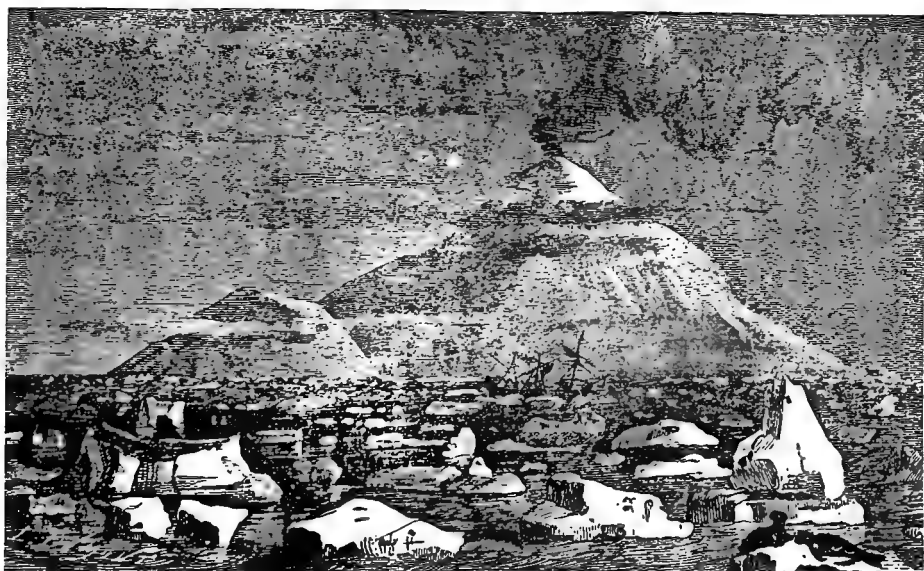
years, has been shown to divide the ocean longitudinally into two basins. Upon this great ridge, and the spurs proceeding from it, rise numerous mountainous masses, which constitute the well-known Atlantic islands and groups of islands. All of these are of volcanic origin, and among them are numerous active volcanoes. The Island of Jan Mayen contains an active volcano, and Iceland contains thirteen, and not improbably more; the Azores have six active volcanoes, the Canaries three; while about eight volcanoes lie off the west coast of Africa. In the West Indies there are six active volcanoes; and three submarine volcanoes have been recorded within the limits of the Atlantic Ocean. Altogether, no less than forty active volcanoes are situated upon the great submarine ridges which traverse the Atlantic longitudinally.

But along the same line the number of extinct volcanoes is far greater, and there are not wanting proofs that the volcanoes which are still active are approaching the condition of extinction.

VOLCANOES OF THE PACIFIC

If the great medial chain of the Atlantic presents us with an example of a chain of volcanic mountains verging on extinction, we have in the line of islands separating the Pacific and Indian Oceans an example of a similar range of volcanic vents which are in a condition of the greatest activity. In the peninsula of Kamchatka there are twelve active volcanoes, in the Aleutian Islands thirty-one, and in the peninsula of Alaska three. The chain of the Kuriles contains at least ten active volcanoes; the Japanese Islands and the islands to the south of Japan twenty-five. The great group of islands lying to the south-east of the Asiatic continent is at the present time the grandest focus of volcanic activity upon the globe. No less than fifty active volcanoes occur here.

Farther south, the same chain is probably continued by the four active volcanoes of New Guinea, one or more submarine volcanoes, and several vents in New Britain, the Solomon Isles, and the New Hebrides, the three active volcanoes of New Zealand, and possibly by Mount Erebus and Mount Terror in the Antarctic region. Altogether, no less than 150 active volcanoes exist in the



MOUNT EREBUS.

Two volcanoes exist in the frozen seas of the Antarctic zone, Mount Erebus and Mount Terror, whose smoking summits indicate a strange conjunction of the forces of fire and frost.

chain of islands which stretch from Behring's Straits down to the Antarctic circle; and if we include the volcanoes on Indian and Pacific Islands which appear to be situated on lines branching from this particular band, we shall not be wrong in the assertion that this great system of volcanic mountains includes at least one half of the habitually active vents of the globe. In addition to the active vents, there are here several hundred very perfect volcanic

cones, many of which appear to have recently become extinct, though some of them may be merely dormant, biding their time.

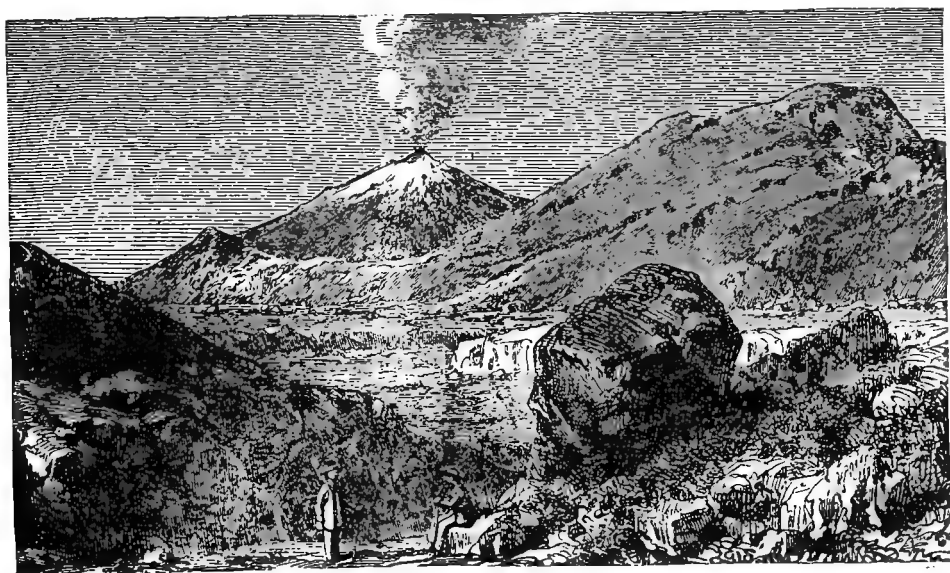
A third series of volcanoes starts from the neighborhood of Behring's Straits, and stretches along the whole western coast of the American continent. This is much less continuous, but nevertheless very important, and contains, with its branches, nearly a hundred active volcanoes. On the north this great band is almost united with the one we have already described by the chain of the Aleutian and Alaska volcanoes. In British Columbia about the parallel of 60° N. there exist a number of volcanic mountains, one of which, Mount St. Elias, is believed to be 18,000 feet in height. Farther south, in the territory of the United States, a number of grand volcanic mountains exist, some of which are probably still active, for geysers and other manifestations of volcanic activity abound. From the southern extremity of the peninsula of California an almost continuous chain of volcanoes stretches through Mexico and Guatemala, and from this part of the volcanic band a branch is given off which passes through the West Indies, and contains the volcanoes which have so recently given evidence of their vital activity.

In South America the line is continued by the active volcanoes of Ecuador, Bolivia and Chili, but at many intermediate points in the chain of the Andes extinct volcanoes occur, which to a great extent fill up the gaps in the series. A small offshoot to the westward passes through the Galapagos Islands. The great band of volcanoes which stretches through the American continent is second only in importance, and in the activity of its vents, to the band which divides the Pacific from the Indian Ocean,

The third volcanic band of the globe is that, already spoken of, which traverses the Atlantic Ocean from north to south. This

series of volcanic mountains is much more broken and interrupted than the other two, and a greater proportion of its vents are extinct. It attained its condition of maximum activity during the distant period of the Miocene, and now appears to be passing into a state of gradual extinction.

Beginning in the north with the volcanic rocks of Greenland and Bear Island, we pass southwards, by way of Jan Mayen, Ice-



MOUNT HECLA—ICELAND.

One of the two most famous of the great Icelandic volcanoes.

land and the Faroe Islands, to the Hebrides and the north of Ireland. Thence, by way of the Azores, the Canaries and the Cape de Verde Islands, with some active vents, we pass to the ruined volcanoes of St. Paul, Fernando de Noronha, Ascension, St. Helena, Trinidad and Tristan da Cunha. From this great Atlantic band two branches proceed to the eastward, one through Central Europe, where all the vents are now extinct, and the other through

the Mediterranean to Asia Minor, the great majority of the volcanoes along the latter line being now extinct, though a few are still active. The volcanoes on the eastern coast of Africa may be regarded as situated on another branch from this Atlantic volcanic band. The number of active volcanoes on this Atlantic band and its branches, exclusive of those in the West Indies, does not exceed fifty.

THIAN SHAN AND HAWAIIAN VOLCANOES

From what has been said, it will be seen that the volcanoes of the globe not only usually assume a linear arrangement, but nearly the whole of them can be shown to be thrown up along three well-marked bands and the branches proceeding from them. The first and most important of these bands is nearly 10,000 miles in length, and with its branches contains more than 150 active volcanoes; the second is 8,000 miles in length, and includes about 100 active volcanoes; the third is much more broken and interrupted, extends to a length of nearly 1,000 miles, and contains about 50 active vents. The volcanoes of the eastern coast of Africa, with Mauritius, Bourbon, Rodriguez, and the vents along the line of the Red Sea, may be regarded as forming a fourth and subordinate band.

Thus we see that the surface of the globe is covered by a network of volcanic bands, all of which traverse it in sinuous lines with a general north-and-south direction, giving off branches which often run for hundreds of miles, and sometimes appear to form a connection between the great bands.

To this rule of the linear arrangement of the volcanic vents of the globe, and their accumulation along certain well-marked bands, there are two very striking exceptions, which we must now proceed to notice.

In the very centre of the continent formed by Europe and Asia, the largest unbroken land-mass of the globe, there rises from the great central plateau the remarkable volcanoes of the Thian Shan Range. The existence of these volcanoes, of which only obscure traditional accounts had reached Europe before the year 1858, appears to be completely established by the researches of recent Russian and Swedish travelers. Three volcanic vents appear to exist in this region, and other volcanic phenomena have been stated to occur in the great plateau of Central Asia, but the existence of the latter appears to rest on very doubtful evidence. The only accounts which we have of the eruptions of these Thian Shan volcanoes are contained in Chinese histories and treatises on geography.

The second exceptionally situated volcanic group is that of the Hawaiian Islands. While the Thian Shan volcanoes rise in the centre of the largest unbroken land-mass, and stand on the edge of the loftiest and greatest plateau in the world, the volcanoes of the Hawaiian Islands rise in the northern centre of the largest ocean and from almost the greatest depths in that ocean. All round the Hawaiian Islands the sea has a depth of from 2,000 to 3,000 fathoms, and the island-group culminates in several volcanic cones, which rise to the height of nearly 14,000 feet above the sea-level. The volcanoes of the Hawaiian Islands are unsurpassed in height and bulk by those of any other part of the globe.

With the exception of the two isolated groups of the Thian Shan and the Hawaiian Islands, nearly all the active volcanoes of the globe are situated near the limits which separate the great land-and-water-masses of the globe—that is to say, they occur either on the parts of continents not far removed from their coast-lines, or on islands in the ocean not very far distant from the shores. The

fact of the general proximity of volcanoes to the sea is one which has frequently been pointed out by geographers, and may now be regarded as being thoroughly established.

VOLCANOES PARALLEL TO MOUNTAIN CHAINS

Many of the grandest mountain-chains have bands of volcanoes lying parallel to them. This is strikingly exhibited by the great mountain-masses which lie on the western side of the American continent. The Rocky Mountains and the Andes consist of folded and crumpled masses of altered strata which, by the action of denuding forces, have been carved into series of ridges and summits. At many points, however, along the sides of these great chains we find that fissures have been opened and lines of volcanoes formed, from which enormous quantities of lava have flowed and covered great tracts of country.

This is especially marked in the Snake River plain of Idaho, in the western United States. In this, and the adjoining regions of Oregon and Washington, an enormous tract of country has been overflowed by lava in a late geological period, the surface covered being estimated to have a larger area than France and Great Britain combined. The Snake River cuts through it in a series of picturesque gorges and rapids, enabling us to estimate its thickness, which is considered to average 4000 feet. Looked at from any point on its surface, one of these lava-plains appears as a vast level surface, like that of a lake bottom. This uniformity has been produced either by the lava rolling over a plain or lake bottom, or by the complete effacement of an original, undulating contour of the ground under hundreds or thousands of feet of lava in successive sheets. The lava, rolling up to the base of the mountains, has followed the sinuosities of their margin, as the waters of a lake

follow its promontories and bays. Similar conditions exist along the Sierra Nevada range of California, and to some extent placer mining has gone on under immense beds of lava, by a process of tunneling beneath the volcanic rock.

In some localities the volcanoes are of such height and dimensions as to overlook and dwarf the mountain-ranges by the side of which they lie. Some of the volcanoes lying parallel to the great American axis appear to be quite extinct, while others are in full activity. In the Eastern continent we find still more striking examples of parallelism between great mountain-chains and the lands along which volcanic activity is exhibited—volcanoes, active or extinct, following the line of the great east and west chains which extend through southern Europe and Asia. There are some other volcanic bands which exhibit a similar parallelism with mountain chains; but, on the other hand, there are volcanoes between which and the nearest mountain-axis no such connection can be traced.

AREAS OF UPHEAVAL AND SUBSIDENCE

There is one other fact concerning the mode of distribution of volcanoes upon the surface of the globe, to which we must allude. By a study of the evidences presented by coral-reefs, raised beaches, submerged forests, and other phenomena of a similar kind, it can be shown that certain wide areas of the land and of the ocean-floor are at the present time in a state of subsidence, while other equally large areas are being upheaved. And the observations of the geologist prove that similar upward and downward movements of portions of the earth's crust have been going on through all geological times.

Now, as Mr. Darwin has so well shown in his work on "Coral-Reefs," if we trace upon a map the areas of the earth's surface

which are undergoing upheaval and subsidence respectively, we shall find that nearly all the active volcanoes of the globe are situated upon rising areas, and that volcanic phenomena are conspicuously absent from those parts of the earth's crust which can be proved at the present day to be undergoing depression.

The remarkable linear arrangement of volcanic vents has a significance that is well worthy of fuller consideration. There are facts known which point to the cause of this state of affairs. It is not uncommon for small cones of scorix to be seen following lines on the flanks or at the base of a great volcanic mountain. These are undoubtedly lines of fissure, caused by the subterranean forces. In fact, such fissures have been seen opening on the sides of Mount Etna, in whose bottom could be seen the glowing lava. Along these fissures, in a few days, scorix cones appeared; on one occasion no less than thirty-six in number.

It is believed by geologists that the linear systems of volcanoes are ranged along similar lines of fissure in the earth's crust—enormous breaks, extending for thousands of miles, and the result of internal energies acting through vast periods of time. Along these immense fissures in the earth's rock-crust there appear, in place of small scorix cones, great volcanoes, built up through the ages by a series of powerful eruptions, and only ceasing to spout fire themselves when the portion of the great crack upon which they lie is closed. The greatest of these fissures is that along the vast sinuous band of volcanoes extending from near the Arctic circle at Behring's Straits to the Antarctic circle at South Victoria Land, not far from half round the earth. It doubtless marks the line of mighty forces which have been active for millions of years.

CHAPTER XV.

Underground Waters and Their Relation to Volcanoes.

THE crust of the earth is only in a general sense a solid mass. In many localities it might be compared to a sponge, full of cavities and ramifying passages, and freely permeable to liquids. While in many places it is composed of dense rock or firm clay, through which water cannot make its way, in others it is rent and splintered, and large cavities here and there exist. Again, much of the material of the crust is porous, water passing somewhat freely through it; and in other localities water makes its way by a process of solution, dissolving and carrying off certain constituents of the rocks. As a result of this permeable condition much of the water which falls upon the earth's surface makes its way into the interior, penetrating the pores and cavities of the crust, which seems to be fully saturated with water.

What may be the actual quantity of water thus held in the earth's crust it is far beyond the present power of science to decide. It must be very great, since, in addition to the free liquid, water exists as a constituent of the hardest rocks. If restored to the surface it would doubtless be sufficient to raise considerably the ocean level, and perhaps to flood all the lower portions of the dry land. In that remote period when the heated condition of the crust prevented the inflow of water, and the whole of earth's liquid element swelled the ocean, such a condition very probably existed.

For ages, as the crust cooled, the waters made their way into the interior, until they reached a considerable depth, and the depression of the ocean level permitted a large section of the surface to emerge as dry land. One important result of this cooling of the surface and narrowing of the oceanic basins has been a decrease in evaporation and rainfall and a localization in the distribution of atmospheric waters, so that large regions of the surface have become deserts. This process of desiccation will doubtless continue in the future, but with great slowness, since the cooling of the earth's crust has become a very deliberate operation.

DISTRIBUTION OF SUBTERRANEAN WATERS

The quantity and distribution of the liquid contents of the crust are very imperfectly known. We can become aware of their distribution only by the upflow of water through springs and the piercing of the surface with wells. It is of interest to find that water exists at some level in almost every locality where such a well has been sunk, and that it is abundant at some of the greatest depths that have been reached, frequently under sufficient pressure to rise to the surface. There are, of course, vast reaches of strata destitute of water in a free state, but these dense strata have failed to check the downflow of the liquid element. Pierce them, and water is found below; pierce still lower strata, and water again outflows, often in large volume. Like the rocks themselves, the liquid contents of the crust seem to exist in successive strata, growing warmer as they lie at greater depths, and usually bearing mineral matter in solution, the product of the rocks through which they have made their way.

ANALOGY OF THE EARTH TO THE HUMAN BODY

An interesting analogy may be shown to exist between the crust of the earth and the human body. The latter, solid exteriorly, is everywhere permeated with streams of flowing liquid,

which pours forth wherever the surface is pierced. In the same manner, if we pierce the earth, its life blood gushes out, now flowing quietly, as from a vein, now spirting freely, as from an artery. Wherever we break through the skin of the great body of the earth the same results appear. In some of the most unpromising localities an abundance of subterranean water seems to exist. Even under the arid surface of the Sahara, the most extended of the earth's deserts, there appears to be an abundant supply of water at a moderate depth, which oozes forth freely at almost every point where an artesian well is sunk. The arid region of Southern California is partly irrigated from a similar subterranean stratum, and like conditions exist in other desert regions of the earth's surface, natural springs oozing up where artificial ones have not been made.

From this we may deduce that, so far as subterranean water is concerned, there is no marked difference between regions of abundant rainfall and those of great aridity. Dry as the soil may be in one locality, moist as it may be in another, the boring-rod of the well-driver reveals a strikingly homogeneous condition in the depths of the crust, and an oasis is formed in the desert wherever there is a passage upward for the underground waters.

MOVEMENTS OF WATERS IN THE EARTH'S CRUST

There is nothing surprising in this. Such a distribution of the subterranean waters is what we might naturally expect to find. Once penetrate to the sub-surface and we reach a region in which the diverse influences of aridity and precipitation fail to assert themselves. Though the surface distribution of water may be localized, the movement beneath the surface is likely to be general, the water following every channel and making its way by multitudinous avenues to regions far removed from its place of origin.

While the surface water may flow through river channels to desert regions, the underground distribution is likely to be more general, since, while the surface represents but a single stratum, there are many underground strata, each affording special opportunities for distribution. While the arid regions of the surface are those of small rainfall, those of the interior are due to impermeable rock strata, and the two conditions are not likely to coincide. It is quite conceivable, indeed, that there may be a far more abundant supply of water beneath a desert than beneath a well-watered region, if the strata in the former case are more permeable than in the latter. The movements of subterranean waters have been going on for ages, and their existing distribution is dependent far more upon freedom of underground flow than upon variation in surface rainfall.

HOW WATER EXISTS IN THE CRUST

If, now, we come to consider the conditions under which the interior water exists, it is impossible to accept a widespread popular conclusion to the effect that flowing streams and rivers of water exist in the depths of the earth's crust. Streams of this character are found in great caverns, and this has doubtless led to the conception that the underground waters exist largely as rivulets or rivers, flowing through interior channels as the blood flows through the veins.

The fact is, however, that apart from the streams found in the cavities in limestone strata, which must somewhere find a passage to the surface, such conditions do not and cannot exist. There are no such deep-lying streams, no great rivers flowing within the earth's crust; the subterranean waters being either at rest, or moving sluggishly as they are drawn off.

The interior of the crust was, in all probability, saturated with water in far remote times, and it is impossible for this water to move except to the extent that it finds a surface vent. It is probably contained almost wholly in porous rocks, and but to a small extent in channels and cavities. For the same reason the inflow is limited, being dependent upon the outflow. A saturated sponge can take in no more water, even if plunged into a full vessel. And there can be no movement of water into its interior, except to the extent that water escapes from its surface. In like manner, if the earth's crust be once saturated, all its pores and cavities filled, no more water can enter, and there can be no movement of the water within except to the extent that the contained liquid has an opportunity to escape.

CHANNELS OF ESCAPE

The most evident channels of escape are those of springs, yielding cold, warm or hot water as they come from varied depths. These are rarely sufficient in number or volume to create any active interior movement, and most generally have to do with superficial strata. They are not confined to the land surface, but frequently open under water, occasionally forming the sole supply of lakes. As one example of this may be instanced Lake Bombon, in the island of Luzon, which has no visible inflow, but has a considerable river for its outflow.

The well may be regarded as an artificial spring, which taps water strata of varied depths, occasionally, no doubt, reaching very ancient accumulations, which have lain undisturbed for ages. If irrigation wells increase very largely in number, as they seem likely to do in the future, they may give rise to a somewhat active movement of the interior waters. The artesian outflow is, of course, limited in quantity, since the sources from which it draws need to

be renewed from the surface, and the seepage downward is a deliberate process and not calculated to yield a rapid new supply. The quantity of water to be obtained from the earth's crust is, therefore, far from inexhaustible, and represents a supply that has been gathering for ages. It may be said further that this water cannot reach the surface except through the influence of pressure, this being usually, perhaps solely, a hydrostatic pressure operating from some supply of water at a higher level, and indicating that the interior waters are to a large extent in continuous contact. It may be, indeed, that the pressure of natural gas has its share in the upflow of water, as it probably has in that of petroleum.

DEPTH OF DESCENT

As regards the depth to which water can descend in the earth's crust, it is to a large extent an open question. Professor King, in his able study of this subject, considers that water may reach to a depth of more than 10,000 feet—how much more he does not venture to suggest. If the crust were permeable to an indefinite distance downward, and water could descend unchecked, a vast volume would be necessary to produce saturation, but there can be no doubt that the rocks grow denser and less permeable as depth increases. The elevation of mountain ranges and the deposition of thick strata of new rock material have undoubtedly greatly compressed the underlying rocks, decreased their porosity, and forced out much of their more ancient water contents, and it is possible that in this way a limiting layer may eventually be formed through which no water can penetrate. Yet at any time the rending action of earthquakes seems capable of opening vast rents in the deeper rock layers, producing cavities sufficient to contain large bodies of water, and to permit the descent of this liquid element to much greater depths.

There appears to be a limiting agency different from this, and one not subject to the action of chance or accident, or to the possible existence of porous rocks at a much lower level than has been estimated. This is a stratum of heat, not of dense rock, and one that seems likely to constitute an effectual check to the descent of water, its action being to reverse the descending tendency of the liquid substance and convert it into an ascending tendency. In other words, the heat at a certain depth must be sufficient to convert the water into steam, which seeks to force itself upward with an energy greater than that with which the superincumbent water seeks to descend. The pressure of water at great depths, it is true, considerably raises the evaporating point, but there is a limit of temperature beyond which no amount of pressure can overcome the tendency to vaporize, and where this degree of heat is reached the possible descent of water comes to an end.

SUBTERRANEAN TEMPERATURE VARIES IN DIFFERENT REGIONS

There are facts which seem to indicate that this limiting layer of temperature varies in depth to a large extent in different regions of the earth. In the Yellowstone Valley, for instance, the phenomena might be held to prove that the inflowing water is converted into steam at a very moderate depth. The multitude of hot springs, the leaping geysers, the whole phenomena of the valley, appear to indicate a high degree of heat at no great distance beneath the surface, a temperature sufficient to vaporize the descending water and hurl it up again in boiling fountains. And the same might be held to be the case in the various other geyser regions of the earth.

This is only one of the phenomena supposed to be due to the conflict between water and heat in the earth's crust. There is

another and a far more important one, that of volcanic eruptions, which are by many held to be results of the conditions here considered. In the geyser, the steam and water have open vents and are free to escape. In the volcano the vents are closed and the imprisoned giant of steam has to force its way to the surface. The boiling lava, which here replaces the hot water of the geysers, is saturated with the water to which its force of uplift is due, and this, as it reaches the surface, flashes again into steam and rends the lava into dust, or so-called ashes. The earthquake, which so often accompanies the eruption, is a result of the same cause, and testifies to the throes of the imprisoned giant in its mighty effort to break its bonds. The whole phenomenon is a striking example of the limitation of the descent of water through the influence of internal heat. This view, of course, is hypothetical, but as an instance in its favor we may refer to the remarkable eruption of Krakatoa in 1883. The suddenness and extreme violence of this eruption suggest the probability that some new opened crevice or cavity admitted the ocean waters in great volume to the heated strata of the mountain depths, and that these waters were converted explosively into steam, which expanded with a force sufficient to blow the mountain into fragments and hurl its debris miles into the air.

THE EXISTENCE OF GEYSERS AND VOLCANOES

While it is possible that the existence of geysers and volcanoes indicates marked differences in the depth of the superheated rock layer, this is by no means necessarily the case. It may simply indicate that they occur in the localities in which the crust is specially permeable to water, and that such results are likely to occur wherever water is able to make its way downward to a sufficient depth. It may be suggested that unbroken strata of dense

rock check the deep descent of water throughout the greater part of the earth's crust, and that it is able to reach the superheated strata only in the limited localities to which the phenomena in question are confined, and also that some of the effects named are likely to appear wherever and whenever the subterranean water does penetrate to this depth.

These considerations lead to the interesting conclusion that the most vigorous activities of the earth's crust—the volcanic eruption, the earthquake and the geyser—are largely due to the action of subterranean water. The same may be said of other activities of the crust. The slipping of strata, to which some earthquakes are credited, may be indirectly caused by the solvent action of water, and the lateral pressure to which mountain elevation is due is held to be a result of surface denudation and the heaping up of new strata beneath the ocean waters.

IMPORTANT SERVICE RENDERED BY WATER

There is a second very important service rendered by water, that of the cooling of the earth's crust. In the primeval period the surface waters were constantly rising as vapor and conveying the superficial heat upwards, to be radiated from the atmosphere into space. In the succeeding period the subterranean water became engaged in similar service. Heated in the lower strata, it rose as the hot spring or the geyser, and in the form of explosive steam it hurled great masses of molten rock to the surface, there to yield its heat to the air. The volume of heat thus conveyed in a century to the surface is very considerable, and in former times was probably much more so. It may much exceed that which reaches the surface by the slow process of conduction.

Subterranean water would thus appear to have long been an agent of the utmost service to the earth, giving rise to the great activities of the crust and aiding essentially in cooling its interior. What will be the future record of this useful agent it is difficult to say. As the crust continues to cool, the waters may make their way to lower depths, unless checked by a general layer of impermeable rock. The cooling of the rocks will also tend to make them more capable of water absorption, and it has been suggested that the ocean waters may all eventually be swallowed up in this way, and the earth become a dry and dead planet like the moon.

DISAPPEARANCE OF THE OCEAN WATERS

This at least we can be sure of, that if such an event takes place it will be at some very remote period in the future. The seepage of water into the earth has long been decreasing with the decrease in the area of rainfall. If the oceans should grow narrower by the partial absorption of their water, the rainless area will grow still more extensive and the area of seepage become more contracted. Civilization is adding to this effect by the removal of the forests. The water once held in their mold and gradually penetrating the surface now hastens downward to the streams and adds much less than formerly to the subterranean supply. As desiccation increases nature will continue what man has begun, the forest area narrowing and the waters rushing with less resistance to the sea. These influences must greatly check the possible future disappearance of the ocean waters within the crust, and whatever the final result may be, many millions of years must pass before the earth can become, from this cause, unfitted for the habitation of man.

Our present concern, however, is with the part played by waters in volcanic eruptions. As already said, this is very great, and in

one form or other, water seems to be the chief agent in volcanic action. Converted suddenly and explosively into steam, when in any manner it makes its way downward to the region of molten rock, it forces a passage upward with terrible energy, before which even the solid mountains themselves give way. As already said, one striking example of this, in the opinion of many scientists, was seen in the frightful explosion of Krakatoa. Not less terrible, and still more destructive in its effects was that of Mont Pelee in 1902, perhaps due to the same cause and of which a full account has been given in preceding chapters.

CHAPTER XVI.

The Famous Vesuvius and the Destruction of Pompeii.

THE famous volcano of Southern Italy named Vesuvius, which is now so constantly in eruption, was described by the ancients as a cone-shaped mountain with a flat top, on which was a deep circular valley filled with vines and grass; and surrounded by high precipices. A large population lived on the sides of the mountain, which was covered with beautiful woods, and there were fine flourishing cities at its foot. So little was the terrible nature of the valley on the top understood, that in A. D. 72, Spartacus, a rebellious Roman gladiator, encamped there with some thousands of fighting men, and the Roman soldiers were let down the precipices in order to surprise and capture them.

There had been earthquakes around the mountain, and one of the cities had been nearly destroyed; but no one was prepared for what occurred seven years after the defeat of Spartacus. Suddenly, in the year 79 A. D., a terrific rush of smoke, steam, and fire belched from the mountain's summit; one side of the valley in which Spartacus had encamped was blown off, and its rocks, with vast quantities of ashes, burning stones, and sand, were ejected far into the sky. They then spread out like a vast pall, and fell far and wide. For eight days and nights this went on, and the enormous quantity of steam sent up, together with the deluge of rain that fell, produced torrents on the mountain-side, which, carrying

onward the fallen ashes, overwhelmed everything in their way. Sulphurous vapors filled the air and violent tremblings of the earth were constant.

A city six miles off was speedily rendered uninhabitable, and was destroyed by the falling stones; but two others—Herculaneum and Pompeii—which already had suffered from the down-pour of ashes, were gradually filled with a flood of water, sand, and ashes, which came down the side of the volcano, and covering them entirely.

BURIED CITIES EXCAVATED.

The difference in ease of excavation is due to the following circumstance. Herculaneum being several miles nearer the crater, was buried in a far more consistent substance, seemingly composed of volcanic ashes cemented by mud; Pompeii, on the contrary, was buried only in ashes and loose stones. The casts of statues found in Herculaneum show the plastic character of the material that fell there, which time has hardened to rock-like consistency.

These statues represented Hercules and Cleopatra, and the theatre proved to be that of the long-lost city of Herculaneum. The site of Pompeii was not discovered until forty years afterward, but work there proved far easier than at Herculaneum, and more progress was made in bringing it back to the light of day.

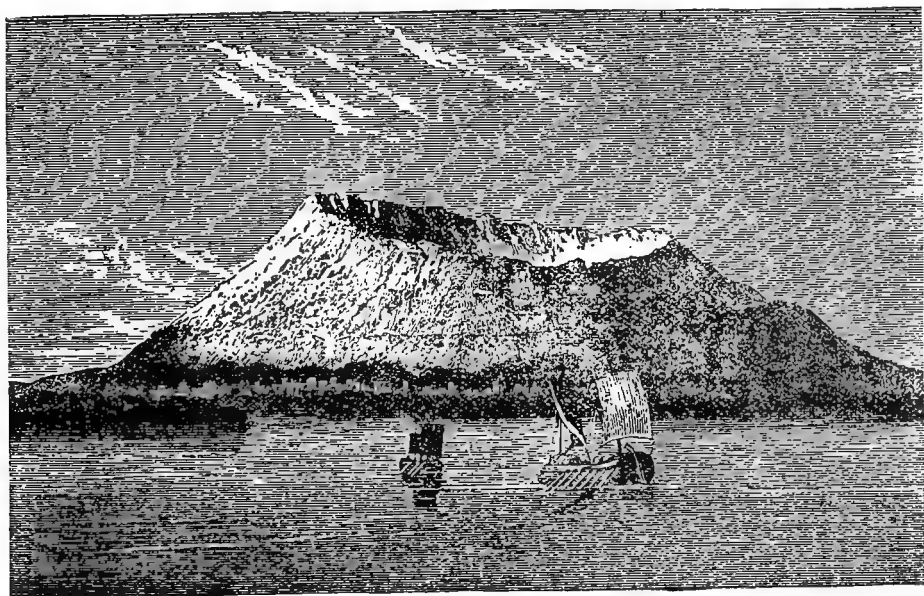
The less solid covering of Pompeii has greatly facilitated the work of excavation, and a great part of the city has been laid bare. Many of its public buildings and private residences are now visible, and some whole streets have been cleared, while a multitude of interesting relics have been found. Among those are casts of many of the inhabitants, obtained by pouring liquid plaster into the ash moulds that remained of them. We see them to-day in the attitude and with the expression of agony and horror with which death met them more than eighteen centuries ago.

In succeeding eruptions much lava was poured out; and in A. D. 472, ashes were cast over a great part of Europe, so that much fear was caused at Constantinople. The buried cities were more and more covered up, and it was not until about A. D. 1700 that, as above stated, the city of Herculaneum was discovered, the peasants of the vicinity being in the habit of extracting marble from its ruins. They had also, in the course of years, found many statues. In consequence, an excavation was ordered by Charles III, the earliest result being the discovery of the theatre, with the statues above named. The work of excavation, however, has not progressed far in this city, on account of its extreme difficulty, though various excellent specimens of art-work have been discovered, including the finest examples of mural painting extant from antiquity. The library was also discovered, 1803 papyri being found. Though these had been charred to cinder, and were very difficult to unroll and decipher, over 300 of them have been read.

PLINY'S CELEBRATED DESCRIPTION

Pliny the Younger, to whom we are indebted for the only contemporary account of the great eruption under consideration, was at the time of its occurrence resident with his mother at Misenum, where the Roman fleet lay, under the command of his uncle, the great author of the "*Historia Naturalis*". His account, contained in two letters to Tacitus (*lib. vi. 16, 20*), is not so much a narrative of the eruption, as a record of his uncle's singular death, yet it is of great interest as yielding the impressions of an observer. The translation which follows is adopted from the very free version of Melmoth, except in one or two places, where it differs much from the ordinary text. The letters are given entire, though some parts are rather specimens of style than good examples of description.

"Your request that I should send an account of my uncle's death, in order to transmit a more exact relation of it to posterity, deserves my acknowledgments; for if this accident shall be celebrated by your pen, the glory of it, I am assured, will be rendered forever illustrious. And, notwithstanding he perished by a misfortune which, as it involved at the same time a most beautiful country in ruins, and destroyed so many populous cities, seems to promise



MOUNT VESUVIUS BEFORE ERUPTION OF A. D. 79.

him an everlasting remembrance; notwithstanding he has himself composed many and lasting works; yet I am persuaded the mention of him in your immortal works will greatly contribute to eternalize his name. Happy I esteem those to be, whom Providence has distinguished with the abilities either of doing such actions as are worthy of being related, or of relating them in a manner worthy of being read; but doubly happy are they who are blessed with

both these talents; in the number of which my uncle, as his own writings and your history will prove, may justly be ranked. It is with extreme willingness, therefore, that I execute your commands; and should, indeed, have claimed the task if you had not enjoined it.

“He was at that time with the fleet under his command at Misenum. On the 24th of August, about one in the afternoon, my mother desired him to observe a cloud which appeared of a very unusual size and shape. He had just returned from taking the benefit of the sun, and, after bathing himself in cold water, and taking a slight repast, had retired to his study. He immediately arose, and went out upon an eminence, from whence he might more distinctly view this very uncommon appearance. It was not at that distance discernible from what mountain the cloud issued, but it was found afterward to ascend from Mount Vesuvius. I cannot give a more exact description of its figure than by comparing it to that of a pine tree, for it shot up to a great height in the form of a trunk, which extended itself at the top into a sort of branches; occasioned, I imagine, either by a sudden gust of air that impelled it, the force of which decreased as it advanced upwards, or the cloud itself being pressed back again by its own weight, and expanding in this manner: it appeared sometimes bright, and sometimes dark and spotted, as it was more or less impregnated with earth and cinders.

“This extraordinary phenomenon excited my uncle’s philosophical curiosity to take a nearer view of it. He ordered a light vessel to be got ready, and gave me the liberty, if I thought proper, to attend him. I rather chose to continue my studies, for, as it happened, he had given me an employment of that kind. As he was passing out of the house he received dispatches: the marines at Retina, terrified at the imminent peril (for the place lay beneath the mountain, and there was no retreat but by ships), entreated his

aid in this extremity. He accordingly changed his first design, and what he began with a philosophical he pursued with an heroical turn of mind.

THE VOYAGE TO STABIÆ

“He ordered the galleys to put to sea, and went himself on board with an intention of assisting not only Retina but many other places, for the population is thick on that beautiful coast. When hastening to the place from whence others fled with the utmost terror, he steered a direct course to the point of danger, and with so much calmness and presence of mind, as to be able to make and dictate his observations upon the motion and figure of that dreadful scene. He was now so nigh the mountain that the cinders, which grew thicker and hotter the nearer he approached, fell into the ships, together with pumice-stones, and black pieces of burning rock ; they were in danger of not only being left aground by the sudden retreat of the sea, but also from the vast fragments which rolled down from the mountain, and obstructed all the shore.

“Here he stopped to consider whether he should return back again ; to which the pilot advised him. ‘Fortune,’ said he, ‘favors the brave ; carry me to Pomponianus.’ Pomponianus was then at Stabiæ, separated by a gulf, which the sea, after several insensible windings, forms upon the shore. He (Pomponianus) had already sent his baggage on board ; for though he was not at that time in actual danger, yet being within view of it, and indeed extremely near, if it should in the least increase, he was determined to put to sea as soon as the wind should change. It was favorable, however, for carrying my uncle to Pomponianus, whom he found in the greatest consternation. He embraced him with tenderness, encouraging and exhorting him to keep up his spirits ; and the more to dissipate his fears he ordered, with an air of unconcern, the

baths to be got ready; when, after having bathed, he sat down to supper with great cheerfulness, or at least (what is equally heroic) with all the appearance of it.

“ In the meantime, the eruption from Mount Vesuvius flamed out in several places with much violence, which the darkness of the night contributed to render still more visible and dreadful. But my uncle, in order to soothe the apprehensions of his friend, assured him it was only the burning of the villages, which the country people had abandoned to the flames; after this he retired to rest, and it was most certain he was so little discomposed as to fall into a deep sleep; for, being pretty fat, and breathing hard, those who attended without actually heard him snore. The court which led to his apartment being now almost filled with stones and ashes, if he had continued there any longer it would have been impossible for him to have made his way out; it was thought proper, therefore, to awaken him. He got up and went to Pomponianus and the rest of his company, who were not unconcerned enough to think of going to bed. They consulted together whether it would be most prudent to trust to the houses, which now shook from side to side with frequent and violent concussions; or to fly to the open fields, where the calcined stone and cinders, though light indeed, yet fell in large showers and threatened destruction. In this distress they resolved for the fields as the less dangerous situation of the two—a resolution which, while the rest of the company were hurried into it by their fears, my uncle embraced upon cool and deliberate consideration.

DEATH OF PLINY THE ELDER

“ They went out, then, having pillows tied upon their heads with napkins; and this was their whole defence against the storm of stones that fell around them. It was now day everywhere else,

but there a deeper darkness prevailed than in the most obscure night; which, however, was in some degree dissipated by torches and other lights of various kinds. They thought proper to go down further upon the shore, to observe if they might safely put out to sea; but they found that the waves still ran extremely high and boisterous. There my uncle, having drunk a draught or two of cold water, threw himself down upon a cloth which was spread for him, when immediately the flames, and a strong smell of sulphur which was the forerunner of them, dispersed the rest of the company, and obliged him to rise. He raised himself up with the assistance of two of his servants, and instantly fell down dead, suffocated, as I conjecture, by some gross and noxious vapor, having always had weak lungs, and being frequently subject to a difficulty of breathing.

“As soon as it was light again, which was not till the third day after this melancholy accident, his body was found entire, and without any marks of violence upon it, exactly in the same posture as that in which he fell, and looking more like a man asleep than dead. During all this time my mother and I were at Misenum. But this has no connection with your history, as your inquiry went no farther than concerning my uncle’s death; with that, therefore, I will put an end to my letter. Suffer me only to add, that I have faithfully related to you what I was either an eye-witness of myself, or received immediately after the accident happened, and before there was any time to vary the truth. You will choose out of this narrative such circumstances as shall be most suitable to your purpose; for there is a great difference between what is proper for a letter and a history; between writing to a friend and writing to the public. Farewell.”

In this account, which was drawn up some years after the event, from the recollections of a student eighteen years old, we recognize

the continual earthquakes; the agitated sea with its uplifted bed; the flames and vapors of an ordinary eruption, probably attended by lava as well as ashes. But it seems likely that the author's memory, or rather the information communicated to him regarding the closing scene of Pliny's life, was defective. Flames and sulphurous vapors could hardly be actually present at Stabiæ, ten miles from the centre of the eruption.

That lava flowed at all from Vesuvius on this occasion has been usually denied; chiefly because at Pompeii and Herculaneum the causes of destruction were different—ashes overwhelmed the former, mud concreted over the latter. We observe, indeed, phenomena on the shore near Torre del Greco which seem to require the belief that currents of lava had been solidified there at some period before the construction of certain walls and floors, and other works of Roman date. In the Oxford Museum, among the specimens of lava to which the dates are assigned, is one referred to A. D. 79, but there is no mode of proving it to have belonged to the eruption of that date.

PLINY'S SECOND LETTER

A second letter from Pliny to Tacitus (*Epist.* 20) was required to satisfy the curiosity of that historian; especially as regards the events which happened under the eyes of his friend. Here it is according to Melmoth:

“The letter which, in compliance with your request, I wrote to you concerning the death of my uncle, has raised, it seems, your curiosity to know what terrors and danger attended me while I continued at Misenum: for there, I think, the account in my former letter broke off.

‘Though my shocked soul recoils, my tongue shall tell.’

“ My uncle having left us, I pursued the studies which prevented my going with him till it was time to bathe. After which I went to supper, and from thence to bed, where my sleep was greatly broken and disturbed. There had been, for many days before, some shocks of an earthquake, which the less surprised us as they are extremely frequent in Campania ; but they were so particularly violent that night, that they not only shook everything about us, but seemed, indeed, to threaten total destruction. My mother flew to my chamber, where she found me rising in order to awaken her. We went out into a small court belonging to the house, which separated the sea from the buildings. As I was at that time but eighteen years of age, I know not whether I should call my behavior, in this dangerous juncture, courage or rashness ; but I took up Livy, and amused myself with turning over that author, and even making extracts from him, as if all about me had been in full security. While we were in this posture, a friend of my uncle's, who was just come from Spain to pay him a visit, joined us ; and observing me sitting with my mother with a book in my hand, greatly condemned her calmness at the same time that he reproved me for my careless security. Nevertheless, I still went on with my author.

“ Though it was now morning, the light was exceedingly faint and languid ; the buildings all around us tottered ; and, though we stood upon open ground, yet as the place was narrow and confined, there was no remaining there without certain and great danger : we therefore resolved to quit the town. The people followed us in the utmost consternation, and, as to a mind distracted with terror every suggestion seems more prudent than its own, pressed in great crowds about us in our way out.

“ Being got to a convenient distance from the houses, we stood still, in the midst of a most dangerous and dreadful scene. The

chariots which we had ordered to be drawn out were so agitated backwards and forwards, though upon the most level ground, that we could not keep them steady, even by supporting them with large stones. The sea seemed to roll back upon itself, and to be driven from its banks by the convulsive motion of the earth ; it is certain at least that the shore was considerably enlarged, and many sea animals were left upon it. On the other side a black and dreadful cloud, bursting with an igneous serpentine vapor, darted out a long train of fire, resembling flashes of lightning, but much larger.

FEAR VERSUS COMPOSURE

“ Upon this the Spanish friend whom I have mentioned, addressed himself to my mother and me with great warmth and earnestness ; ‘ If your brother and your uncle,’ said he, ‘ is safe, he certainly wishes you to be so too ; but if he has perished, it was his desire, no doubt, that you might both survive him : why therefore do you delay your escape a moment ?’ We could never think of our own safety, we said, while we were uncertain of his. Hereupon our friend left us, and withdrew with the utmost precipitation. Soon afterward, the cloud seemed to descend, and cover the whole ocean ; as it certainly did the island of Capreæ, and the promontory of Misenum. My mother strongly conjured me to make my escape at any rate, which, as I was young, I might easily do ; as for herself, she said, her age and corpulency rendered all attempts of that sort impossible. However, she would willingly meet death, if she could have the satisfaction of seeing that she was not the occasion of mine. But I absolutely refused to leave her, and taking her by the hand, I led her on ; she complied with great reluctance, and not without many reproaches to herself for retarding my flight.

“ The ashes now began to fall upon us, though in no great

quantity. I turned my head and observed behind us a thick smoke, which came rolling after us like a torrent. I proposed, while we yet had any light, to turn out of the high road lest she should be pressed to death in the dark by the crowd that followed us. We had scarce stepped out of the path when darkness overspread us, not like that of a cloudy night, or when there is no moon, but of a room when it is all shut up and all the lights are extinct. Nothing then was to be heard but the shrieks of women, the screams of children and the cries of men; some calling for their children, others for their parents, others for their husbands, and only distinguishing each other by their voices; one lamenting his own fate, another that of his family; some wishing to die from the very fear of dying; some lifting their hands to the gods; but the greater part imagining that the last and eternal night was come, which was to destroy the gods and the world together. Among them were some who augmented the real terrors by imaginary ones, and made the frightened multitude believe that Misenum was actually in flames.

“At length a glimmering light appeared, which we imagined to be rather the forerunner of an approaching burst of flames, as in truth it was, than the return of day. However, the fire fell at a distance from us; then again we were immersed in thick darkness, and a heavy shower of ashes rained upon us, which we were obliged every now and then to shake off, otherwise we should have been crushed and buried in the heap.

“I might boast that, during all this scene of horror, not a sigh or expression of fear escaped me, had not my support been founded in that miserable, though strong, consolation that all mankind were involved in the same calamity, and that I imagined I was perishing with the world itself! At last this dreadful darkness was dissipated by degrees, like a cloud of smoke; the real day returned,

and soon the sun appeared, though very faintly, and as when an eclipse is coming on. Every object that presented itself to our eyes (which were extremely weakened) seemed changed, being covered over with white ashes, as with a deep snow. We returned to Misenum, where we refreshed ourselves as well as we could, and passed an anxious night between hope and fear, for the earthquake still continued, while several greatly excited people ran up and down, heightening their own and their friends' calamities by terrible predictions. However, my mother and I, notwithstanding the danger we had passed and that which still threatened us, had no thoughts of leaving the place till we should receive some account from my uncle.

"And now you will read this narrative without any view of inserting it in your history, of which it is by no means worthy; and, indeed, you must impute it to your own request if it shall not even deserve the trouble of a letter. Farewell!"

DION CASSIUS ON THE ERUPTION

The story told by Pliny is the only one upon which we can rely. Dion Cassius, the historian, who wrote more than a century later, does not hesitate to use his imagination, telling us that Pompeii was buried under showers of ashes "while all the people were sitting in the theatre." This statement has been effectively made use of by Bulwer, in his "Last Days of Pompeii." In this he pictures for us a gladiatorial combat in the arena, with thousands of deeply interested spectators occupying the surrounding seats. The novelist works his story up to a thrilling climax in which the volcano plays a leading part.

This is all very well as a vivid piece of fiction, but it does not accord with fact, since Dion Cassius was undoubtedly incorrect in



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**PHOTOGRAPHIC PICTURE OF BLACKENED CORPSES PROTRUDING FROM DUST COVERED
RUINS OF THE PRINCIPAL STREET OF ST. PIERRE.**



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**A PHOTOGRAPHIC PICTURE SHOWING WHERE SEVENTEEN DEAD BODIES WERE STREWN
IN THE ROADWAY IN ST PIERRE NEAREST THE VOLCANO.**

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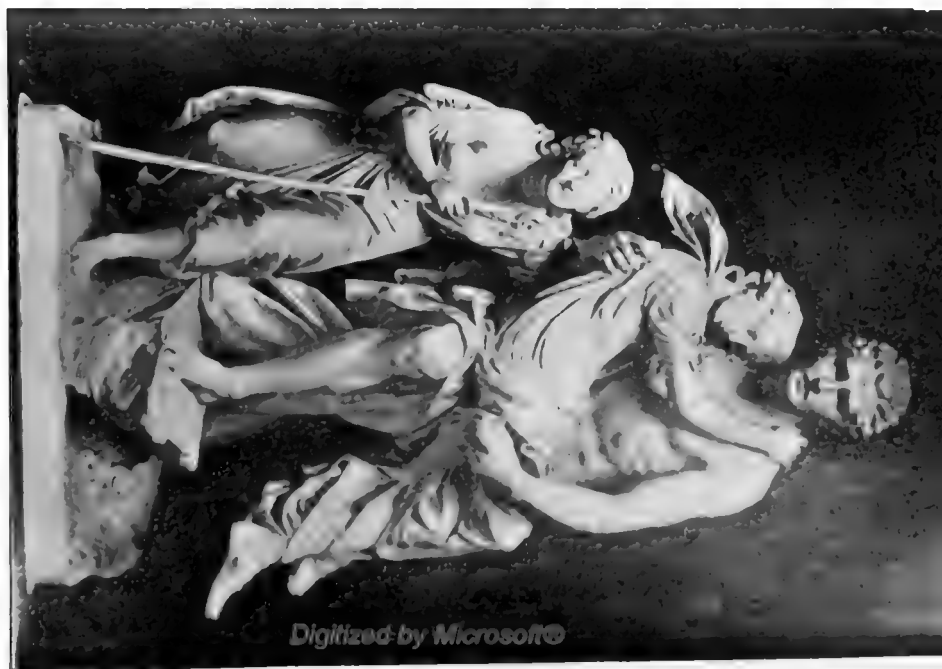
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A PHOTOGRAPHIC VIEW OF THE RUINS IN BUSINESS SECTION OF ST. PIERRE, MUCH LIKE THE RUINS FOUND AT POMPEII.





A BODY TURNED TO STONE
 Dug from the Ruins of Pompeii.



FLEEING FROM THE DESTRUCTION OF POMPEII
 A Realistic Group of Statuary





AN ARCH OF BAMBOO, CHARACTERISTIC OF WINDWARD ISLANDS



A TYPICAL WATERFALL IN THE WINDWARD ISLANDS



his statement. We now know from the evidence furnished by the excavations that none of the people were destroyed in the theatres, and, indeed, that there were very few who did not escape from both cities. It is very likely that many of them returned and dug down for the most valued treasures in their buried habitations. Dion Cassius may have obtained the material for his accounts from the traditions of the descendants of survivors, and if so he shows how terrible must have been the impression made upon their minds. He assures us that during the eruption a multitude of men of superhuman nature appeared, sometimes on the mountain and sometimes in the environs, that stones and smoke were thrown out, the sun was hidden, and then the giants seemed to rise again, while the sounds of trumpets were heard.

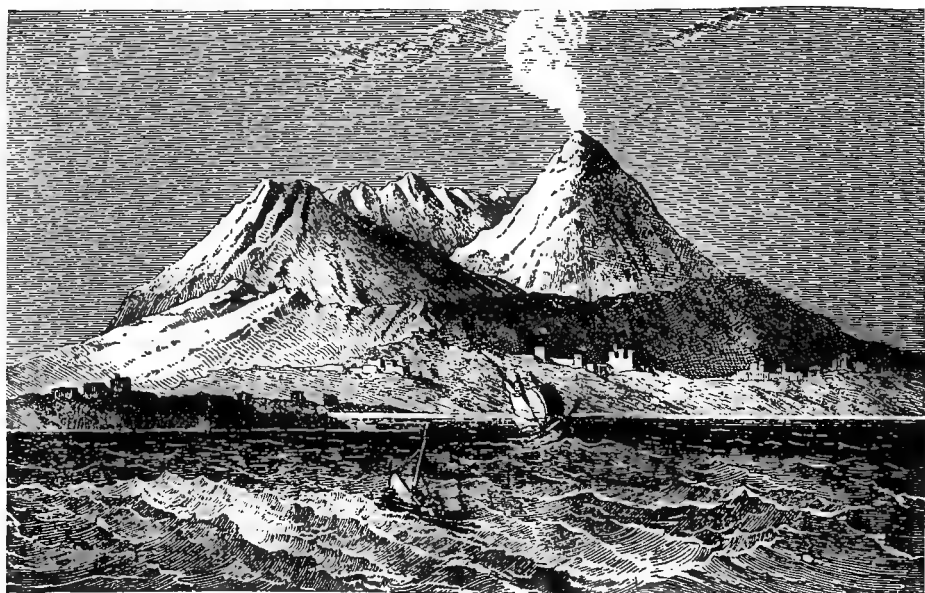
LAKE AVERNUS

Not far from Vesuvius lay the famous Lake Avernus, whose name was long a popular synonym for the infernal regions. The lake is harmless to-day, but its reputation indicates that it was not always so. There is every reason to believe that it hides the outlet of an extinct volcano, and that long after the volcano ceased to be active it emitted gases as fatal to animal life as those suffocating vapors which annihilated all the cattle on the Island of Lancerote, in the Canaries, in the year 1730. Its name signifies "birdless," indicating that its ascending vapors were fatal to all birds that attempted to fly above its surface.

In the superstition of the Middle Ages Vesuvius assumed the character which had before been given to Avernus, and was regarded as the mouth of hell. Cardinal Damiano, in a letter to Pope Nicholas II., written about the year 1060, tells the story of how a priest, who had left his mother ill at Beneventum, went on

his homeward way to Naples past the crater of Vesuvius, and heard issuing therefrom the voice of his mother in great agony. He afterward found that her death coincided exactly with the time at which he had heard her voice.

A trip to the summit of Vesuvius is one of the principal attractions for strangers who are visiting Naples. There is a fascination about that awful slayer of cities which few can resist, and no



A LATER VIEW OF MOUNT VESUVIUS

less attractive is the city of Pompeii, now largely laid bare after being buried for eighteen centuries. We are indebted to Henry Haynie for the following interesting description : "Once seen, it will never be forgotten. It is full of suggestions. It kindles emotions that are worth the kindling, and brings on dreams that are worth the dreaming. Of the three places overwhelmed, Herculaneum, Pompeii and Stabiæ, the last scarcely repays excavation in one

sense, and the first in another ; but to watch the diggers at Pompeii is fascinating, even when there is no reasonable expectation of a find. Herculaneum was buried with lava, or rather with tufa, and it is so very hard that the expense of uncovering of only a small part of that city has been very great.

HOW POMPEII IMPRESSES ITS VISITORS

“Pompeii was smothered in ashes, however, and most of it is uncovered now. But while there is much that is fascinating, and all of it is instructive, there is nothing grand or awe-inspiring in the ruins of Pompeii. No visitor stands breathless as in the great hall of Karnak or in the once dreadful Coliseum at Rome, or dreams with sensuous delight as before the Jasmine Court at Agra.

“The weirdness of the scene possesses us as a haunted chamber might. We have before us the narrow lanes, paved with tufa, in which Roman wagon wheels have worn deep ruts. We cross streets on stepping-stones which sandaled feet ages ago polished. We see the wine shops with empty jars, counters stained with liquor, stone mills where the wheat was ground, and the very ovens in which bread was baked more than eighteen centuries ago. ‘Welcome’ is offered us at one silent, broken doorway ; at another we are warned to ‘Beware of the dog!’ The painted figures,—some of them so artistic and rich in colors that pictures of them are disbelieved,—the mosaic pavements, the empty fountains, the altars and household gods, the marble pillars and the small gardens are there just as the owners left them. Some of the walls are scribbled over by the small boys of Pompeii in strange characters which mock modern erudition. In places we read the advertisements of gladiatorial shows, never to come off, the names of candidates for legislative office who were never to sit. There is nothing like this elsewhere.

“The value of Pompeii to those classic students who would understand, not the speech only, but the life and the every-day habits, of the ancient world, is too high for reckoning. Its inestimable evidence may be seen in the fact that any high-school boy can draw the plan of a Roman house, while ripest scholars hesitate on the very threshold of a Greek dwelling. This is because no Hellenic Pompeii has yet been discovered, but thanks to the silent city close to the beautiful Bay of Naples, the Latin house is known from ostium to porticus, from the front door to the back garden wall.

STREETS AND HOUSES OF POMPEII

“The streets of Pompeii must have had a charm unapproached by those of any city now in existence. The stores, indeed, were wretched little dens. Two or three of them commonly occupied the front of a house on either side of the entrance, the ostium; but when the door lay open, as was usually the case, a passerby could look into the atrium, prettily decorated and hung with rich stuffs. The sunshine entered through an aperture in the roof, and shone on the waters of the impluvium, the mosaic floor, the altar of the household gods and the flowers around the fountain.

“As the life of the Pompeiians was all outdoors, their pretty homes stood open always. There was indeed a curtain betwixt the atrium and the peristyle, but it was drawn only when the master gave a banquet. Thus a wayfarer in the street could see, beyond the hall described and its busy servants, the white columns of the peristyle, with creepers trained about them, flowers all around, and jets of water playing through pipes which are still in place. In many cases the garden itself could be observed between the pillars of the further gallery, and rich paintings on the wall beyond that.

"But how far removed those little palaces of Pompeii were from our notion of well-being is scarcely to be understood by one who has not seen them. It is a question strange in all points of view where the family slept in the houses, nearly all of which had no second story. In the most graceful villas the three to five sleeping chambers round the atrium and four round the peristyle were rather ornamental cupboards than aught else. One did not differ from another, and if these were devoted to the household the slaves, male and female, must have slept on the floor outside. The master, his family and his guest used these small, dark rooms, which were apparently without such common luxuries as we expect in the humblest home. All their furniture could hardly have been more than a bed and a footstool; but it should be remembered that the public bath was a daily amusement. The kitchen of each villa certainly was not furnished with such ingenuity, expense or thought as the stories of Roman gormandising would have led us to expect. In the house of the *Ædile*—so called from the fact that '*Pansam Æd.*' is inscribed in red characters by the doorway—the cook seems to have been employed in frying eggs at the moment when increasing danger put him to flight. His range, four partitions of brick, was very small; a knife, a strainer, a pan lay by the fire just as they fell from the slave's hand."

VALUE OF THE DISCOVERY OF POMPEII

This description strongly presents to us the principal value of the discovery of Pompeii. Interesting as are the numerous works of art found in its habitations, and important as is their bearing upon some branches of the art of the ancient world, this cannot compare in interest with the flood of light which is here thrown on ancient life in all its details, enabling us to picture to ourselves the

manners and habits of life of a cultivated and flourishing population at the beginning of the Christian era, to an extent which no amount of study of ancient history could yield.

Looking upon the work of the volcano as essentially destructive, as we naturally do, we have here a valuable example of its power as a preservative agent ; and it is certainly singular that it is to a volcano we owe much of what we know concerning the cities, dwellings and domestic life of the people of the Roman Empire.

It would be very fortunate for students of antiquity if similar disasters had happened to cities in other ancient civilized lands, however unfortunate it might have been to their inhabitants. But doubtless we are better off without knowledge gained from ruins thus produced.

CHAPTER XVII.

Eruptions of Vesuvius, Etna and Stromboli.

MOUNT VESUVIUS is of especial interest as being the only active volcano on the continent of Europe—all others of that region being on the islands of the Mediterranean—and for the famous ancient eruption described in the last chapter. Before this it had borne the reputation of being extinct, but since then it has frequently shown that its fires have not burned out, and has on several occasions given a vigorous display of its powers.

During the fifteen hundred years succeeding the destructive event described eruptions were of occasional occurrence, though of no great magnitude. But throughout the long intervals when Vesuvius was at rest it was noted that Etna and Ischia were more or less disturbed.

THE BIRTH OF MONTE NUOVO

In 1538 a startling evidence was given that there was no decline of energy in the volcanic system of Southern Italy. This was the sudden birth of the mountain still known as Monte Nuovo, or New Mountain, which was thrown up in the Campania near Avernus, on the spot formerly occupied by the Lucrine Lake.

For about two years prior to this event the district had been disturbed by earthquakes, which on September 27 and 28, 1538, became almost continuous. The low shore was slightly elevated, so that the sea retreated, leaving bare a strip about two hundred feet in width. The surface cracked, steam escaped, and at last,

early on the morning of the 29th, a greater rent was made, from which were vomited furiously "smoke, fire, stones and mud composed of ashes, making at the time of its opening a noise like the loudest thunder."

The ejected material in less than twelve hours built the hill which has lasted substantially in the same form to our day. It is a noteworthy fact that since the formation of Monte Nuovo there has been no volcanic disturbance in any part of the Neapolitan district except in Vesuvius, which for five centuries previous had remained largely at rest.

LAVA FROM VESUVIUS

The first recognised appearance of lava in the eruptions of Vesuvius was in the violent eruption of 1036. This was succeeded at intervals by five other outbreaks, none of them of great energy. After 1500 the crater became completely quiet, the whole mountain in time being grown over with luxuriant vegetation, while by the next century the interior of the crater became green with shrubbery, indicating that no injurious gases were escaping.

This was sleep, not death. In 1631 the awakening came in an eruption of terrible violence. Almost in a moment the green mantle of woodland and shrubbery was torn away and death and destruction left where peace and safety had seemed assured.

Seven streams of lava poured from the crater and swept rapidly down the mountain side, leaving ruin along their paths. Resina, Granasello and Torre del Greco, three villages that had grown up during the period of quiescence, were more or less overwhelmed by the molten lava. Great torrents of hot water also poured out, adding to the work of desolation. It was estimated that eighteen thousand of the inhabitants were killed.

What made the horror all the greater was a frightful error of judgment, similar to that of the Governor of Martinique at St. Pierre. The Governor of Torre del Greco had refused to be warned in time, and prevented the people from making their escape until it was too late. Not until the lava had actually reached the walls was the order for departure given. Before the order could be acted upon the molten streams burst through the walls into the crowded streets and overwhelmed the vast majority of the inhabitants.

In this violent paroxysm the whole top of the mountain is said to have been swept away, the new crater which took the place of the old one being greatly lowered. From that date Vesuvius has never been at rest for any long interval, and eruptions of some degree of violence have been rarely more than a few years apart. Of its various later manifestations of energy we select for description that of 1767, of which an interesting account by a careful observer is extant.

GREAT ERUPTION OF 1767

From the 10th of December, 1766, to March, 1767, Vesuvius was quiet; then it began to throw up stones from time to time. In April the throws were more frequent, and at night the red glare grew stronger on the cloudy columns which hung over the crater. These repeated throws of cinders, ashes and pumice-stones so much increased the small cone of eruption which had been left in the centre of the flat crateral space that its top became visible at a distance.

On the 7th of August there issued a small stream of lava from a breach in the side of a small cone; the lava gradually filled the space between the cone and the crateral edge; on the 12th of September it overflowed the crater, and ran down the mountain.

Stones were ejected which took ten seconds in their fall, from which it may be computed that the height which the stones reached was 1,600 feet. Padre Torre, a great observer of Vesuvius, says they went up above a thousand feet. The lava ceased on the 18th of October, but at 8 A. M. on the 19th it rushed out at a different place, after volleys of stones had been thrown to an immense height, and the huge traditional pine-tree of smoke reappeared. On this occasion that vast phantom extended its menacing shadow over Capri, at a distance of twenty-eight miles from Vesuvius.

The lava at first came out of a mouth about one hundred yards below the crater, on the side toward Monte Somma. While occupied in viewing this current, the observer heard a violent noise within the mountain; saw it split open at the distance of a quarter of a mile, and saw from the new mouth a mountain of liquid fire shoot up many feet, and then, like a torrent, roll on toward him. The earth shook; stones fell thick around him; dense clouds of ashes darkened the air; loud thunders came from the mountain top, and he took to precipitate flight. The Padre's account is too lively and instructive for his own words to be omitted.

PADRE TORRE'S NARRATIVE

"I was making my observations upon the lava, which had already, from the spot where it first broke out, reached the valley, when, on a sudden, about noon, I heard a violent noise within the mountain, and at a spot about a quarter of a mile off the place where I stood the mountain split; and with much noise, from this new mouth, a fountain of liquid fire shot up many feet high, and then like a torrent rolled on directly towards us. The earth shook at the same time that a volley of stones fell thick upon us; in an instant clouds of black smoke and ashes caused almost a total

darkness ; the explosions from the top of the mountain were much louder than any thunder I ever heard, and the smell of the sulphur was very offensive. My guide, alarmed, took to his heels ; and I must confess that I was not at my ease. I followed close, and we ran near three miles without stopping ; as the earth continued to shake under our feet, I was apprehensive of the opening of a fresh mouth which might have cut off our retreat.

“I also feared that the violent explosions would detach some of the rocks off the mountain of Somma, under which we were obliged to pass ; besides, the pumice-stones, falling upon us like hail, were of such a size as to cause a disagreeable sensation in the part upon which they fell. After having taken breath, as the earth trembled greatly I thought it most prudent to leave the mountain and return to my villa, where I found my family in great alarm at the continual and violent explosions of the volcano, which shook our house to its very foundation, the doors and windows swinging upon their hinges.

“About two of the clock in the afternoon (19th) another lava stream forced its way out of the same place from whence came the lava of last year, so that the conflagration was soon as great on this side of the mountain as on the other which I had just left. I observed on my way to Naples, which was in less than two hours after I had left the mountain, that the lava had actually covered three miles of the very road through which we had retreated. This river of lava in the Atrio del Cavallo was sixty or seventy feet deep, and in some places nearly two miles broad. Besides the explosions, which were frequent, there was a continued subterranean and violent rumbling noise, which lasted five hours in the night,—supposed to arise from contact of the lava with rain-water lodged in cavities within. The whole neighborhood was shaken

violently ; Portici and Naples were in the extremity of alarm ; the churches were filled ; the streets were thronged with processions of saints, and various ceremonies were performed to quell the fury of the mountain.

“ In the night of the 20th, the occasion being critical, the prisoners in the public jail attempted to escape, and the mob set fire to the gates of the residence of the Cardinal Archbishop because he refused to bring out the relics of St. Januarius. The 21st was a quieter day, but the whole violence of the eruption returned on the 22d, at 10 A. M., with the same thundering noise, but more violent and alarming. Ashes fell in abundance in the streets of Naples, covering the housetops and balconies an inch deep. Ships at sea, twenty leagues from Naples, were covered with them.

“ In the midst of these horrors, the mob, growing tumultuous and impatient, obliged the Cardinal to bring out the head of St. Januarius, at the extremity of Naples, toward Vesuvius ; and it is well attested here that the eruption ceased the moment the saint came in sight of the mountain. It is true the noise ceased about that time after having lasted five hours, as it had done the preceding days.

“ On the 23d the lava still ran, but on the 24th it ceased ; but smoke continued. On the 25th there rose a vast column of black smoke, giving out much forked lightning with thunder, in a sky quite clear except for the smoke of the volcano. On the 26th smoke continued, but on the 27th the eruption came to an end.”

This eruption was also described by Sir William Hamilton, who continued to keep a close watch on the movements of the volcano for many years. The next outbreak of especial violence took place in 1779, when what seemed to the eye a column of fire ascended two miles high, while cinder fragments fell far and wide,

destroying the hopes of harvest throughout a wide district. They fell in abundance thirty miles distant, and the dust of the explosion was carried a hundred miles away.

In 1793 the crater became active again, and in 1794, after a period of short tranquillity or comparative inaction, the mountain again became agitated, and one of the most formidable eruptions known in the history of Vesuvius began. It was in some respects unlike many others, being somewhat peculiar as to the place of its outburst, the temperature of the lava, and the course of the current. Breislak, an Italian geologist, observed the characteristic phenomena with the eye of science, and his account supplies many interesting facts.

BREISLAK ON THE ERUPTION OF 1794

Breislak remarked certain changes in the character of the earth-motions during this six hours' eruption, which led him to some particular conjecture of the cause. At the beginning the trembling was continual, and accompanied by a hollow noise, similar to that occasioned by a river falling into a subterranean cavern. The lava, at the time of its being disgorged, from the impetuous and uninterrupted manner in which it was ejected, causing it to strike violently against the walls of the vent, occasioned a continual oscillation of the mountain. Toward the middle of the night this vibratory motion ceased, and was succeeded by distant shocks. The fluid mass, diminished in quantity, now pressed less violently against the walls of the aperture, and no longer issued in a continual and gushing stream, but only at intervals, when the interior fermentation elevated the boiling matter above the mouth. About 4 A. M. the shocks began to be less numerous, and the intervals between them rendered their force and duration more perceptible.

During this tremendous eruption at the base of the Vesuvian cone, and the fearful earthquakes which accompanied it, the summit was tranquil. The sky was serene, the stars were brilliant, and only over Vesuvius hung a thick, dark smoke-cloud, lighted up into an auroral arch by the glare of a stream of fire more than two miles long, and more than a quarter of a mile broad. The sea was calm, and reflected the red glare; while from the source of the lava came continual jets of uprushing incandescent stones. Nearer to view, Torre del Greco in flames, and clouds of black smoke, with falling houses, presented a dark and tragical foreground, heightened by the subterranean thunder of the mountain, and the groans and lamentations of fifteen thousand ruined men, women and children.

The heavy clouds of ashes which were thrown out on this occasion gathered in the early morning into a mighty shadow over Naples and the neighborhood; the sun rose pale and obscure, and a long, dim twilight reigned afterward.

Such were the phenomena on the western side of Vesuvius. They were matched by others on the eastern aspect, not visible at Naples, except by reflection of their light in the atmosphere. The lava on this side flowed eastward, along a route often traversed by lava, by the broken crest of the Cognolo and the valley of Sorienta. The extreme length to which this current reached was not less than an Italian mile. The cubic content was estimated to be half that already assigned to the western currents. Taken together they amounted to 20,744,445 cubic metres, or 2,804,440 cubic fathoms; the constitution of the lava being the same in each, both springing from one deep-seated reservoir of fluid rock.

The eruption of lava ceased on the 16th, and then followed heavy discharges of ashes, violent shocks of earthquakes, thunder and lightning in the columns of vapors and ashes, and finally heavy

rains, lasting till the 3d of July. The barometer during all the eruption was steady.

Breislak made an approximate calculation of the quantity of ashes which fell on Vesuvius during this great eruption, and states the result as equal to what would cover a circular area 6 kilometres (about $3\frac{1}{2}$ English miles) in radius, and 39 centimetres (about 15 inches) in depth.

STRANGE EFFECTS

Among the notable things which attended this eruption, it is recorded that in Torre del Greco metallic and other substances exposed to the current were variously affected. Silver was melted, glass became porcelain, iron swelled to four times its volume and lost its texture. Brass was decomposed, and its constituent copper crystallized in cubic and octahedral forms aggregated in beautiful branches. Zinc was sometimes turned to blende. During the eruption, the lip of the crater toward Bosco Tre Case on the south-east, fell in, or was thrown off, and the height of that part was reduced 426 feet.

On the 17th, the sea was found in a boiling state 100 yards off the new promontory made by the lava of Torre del Greco, and no boat could remain near it on account of the melting of the pitch in her bottom. For nearly a month after the eruption vast quantities of fine white ashes, mixed with volumes of steam, were thrown out from the crater; the clouds thus generated were condensed into heavy rain, and large tracts of the Vesuvian slopes were deluged with volcanic mud. It filled ravines, such as Fosso Grande, and concreted and hardened there into pumiceous tufa—a very instructive phenomenon.

Immense injury was done to the rich territory of Somma, Ottajano and Bosco by heavy rains, which swept along cinders, broke

up the road and bridges, and overturned trees and houses for the space of fifteen days.

There were few years during the nineteenth century in which Vesuvius did not show symptoms of its internal fires, and at intervals it manifested much activity, though not equaling the terrible eruptions of its past history. The severest eruptions in that century were those of 1871 and 1876. In the first a sudden emission of lava killed twenty spectators at the mouth of the crater, and only spent its fury after San Sebastian and Massa had been well nigh annihilated. Fragments of rock were thrown up to the height of 4,000 feet, and the explosions were so violent that the whole countryside fled panic stricken to Naples. The activity of the volcano, accompanied by distinct shocks of earthquake, lasted for a week.

In 1876, for three weeks together, lava streamed down the side of Vesuvius, sweeping away the village of Cercolo and running nearly to the sea at Ponte Maddaloni. There were then formed ten small craters within the greater one. But these were united by a later eruption in 1888, and pressure from beneath formed a vast cone where they had been.

HARDIHOOD OF THE PEOPLE

It may seem strange that so dangerous a neighborhood should be inhabited. But so it is. Though Pompeii, Herculaneum and Stabiæ lie buried beneath the mud and ashes belched out of the mouth of Vesuvius, the villages of Portici and Revina, Torre del Greco and Torre del Annunziata have taken their place, and a large population, cheerful and prosperous, flourishes around the disturbed mountain and over the district of which it is the somewhat untrustworthy safety-valve.

It is thus that man, in his eagerness to cultivate all available parts of the earth, dares the most frightful perils and ventures into the most threatening situations, seeking to snatch the means of life from the very jaws of death. The danger is soon forgotten, the need of cultivation of the ground is ever pressing, and no threats of peril seem capable of restraining the activity of man for many years. Though the proposition of abandoning the Island of Martinique has been seriously considered, the chances are that, before many years have passed, a cheerful and busy population will be at work again on the flanks of Mont Pelee.

MOUNT ETNA

On the eastern coast of the Island of Sicily, and not far from the sea, rises in solitary grandeur Mount Etna, the largest and highest of European volcanoes. Its height above the level of the sea is a little over 10,870 feet, considerably above the limit of perpetual snow. It accordingly presents the striking phenomenon of volcanic vapors ascending from a snow-clad summit. The base of the mountain is eighty-seven miles in circumference, and nearly circular; but there is a wide additional extent all around over-spread by its lava. The lower portions of the mountain are exceedingly fertile, and richly adorned with corn-fields, vineyards, olive-groves and orchards. Above this region are extensive forests, chiefly of oak, chesnut, and pine, with here and there clumps of cork-trees and beech. In this forest region are grassy glades, which afford rich pasture to numerous flocks. Above the forest lies a volcanic desert, covered with black lava and slag. Out of this region, which is comparatively flat, rises the principal cone, about 1,100 feet in height, having on its summit the crater, whence sulphurous vapors are continually evolved.

The great height of Etna has exerted a remarkable influence on its general conformation: for the volcanic forces have rarely been of sufficient energy to throw the lava quite up to the crater at the summit. The consequence has been, that numerous subsidiary craters and cones have been formed all around the flanks of the mountain, so that it has become rather a cluster of volcanoes than a single volcanic cone.

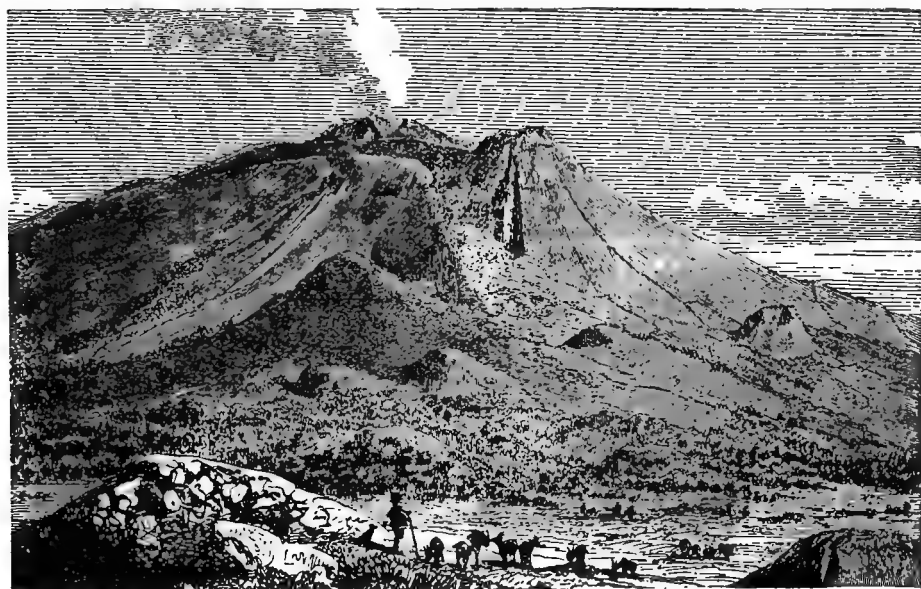
The eruptions of this mountain have been numerous, records of them extending back to several centuries before the Christian era, while unrecorded ones doubtless took place much further back. After the beginning of the Christian era, and more especially after the breaking forth of Vesuvius in 79 A. D., Etna enjoyed longer intervals of repose. Its eruptions since that time have nevertheless been numerous—more especially during the intervals when Vesuvius was inactive—there being a sort of alternation between the periods of great activity of the two mountains; although there are not a few instances of their having been both in action at the same time.

SIMILARITY IN ETNA'S ERUPTIONS

There is a great similarity in the character of the eruptions of Etna. Earthquakes presage the outburst, loud explosions follow, rifts and *bocche del fuoco* open in the sides of the mountain; smoke, sand, ashes and scorix are discharged, the action localizes itself in one or more craters, cinders are thrown up and accumulate around the crater and cone, ultimately lava rises and frequently breaks down one side of the cone where the resistance is least; then the eruption is at an end.

Smyth says: "The symptoms which precede an eruption are generally irregular clouds of smoke, *ferilli* or volcanic lightnings,

hollow intonations and local earthquakes that often alarm the surrounding country as far as Messina, and have given the whole province the name of Val Demone, as being the abode of infernal spirits. These agitations increase until the vast cauldron becomes surcharged with the fused minerals, when, if the convulsion is not sufficiently powerful to force them from the great crater (which, from its great altitude and the weight of the candent matter,



MOUNT ETNA

requires an uncommon effort), they explode through that part of the side which offers the least resistance with a grand and terrific effect, throwing red-hot stones and flakes of fire to an incredible height, and spreading ignited cinders and ashes in every direction."

After the eruption of ashes, lava frequently follows, sometimes rising to the top of the cone of cinders, at others disrupting it on the least resisting side. When the lava has reached the base of

the cone it begins to flow down the mountain, and, being then in a very fluid state, it moves with great velocity. As it cools, the sides and surface begin to harden, its velocity decreases, and after several days it moves only a few yards an hour. The internal portions, however, part slowly with their heat, and months after the eruption clouds of steam arise from the black and externally cold lava-beds after rain ; which, having penetrated through the cracks, has found its way to the heated mass within.

THE ERUPTION OF 1669

The most memorable of the eruptions of Etna was that which elevated the double cone of Monte Rossi and destroyed a large part of the city of Catania. It happened in the year 1669, and was preceded by an earthquake, which overthrew the town of Nicolosi, situated ten miles inland from Catania, and about twenty miles from the top of Etna. The eruption began with the sudden opening of an enormous fissure, extending from a little way above Nicolosi to within about a mile of the top of the principal cone, its length being twelve miles, its average breadth six feet, its depth unknown.

We have a more detailed account of this eruption than of any preceding one, as it was observed by men of science from various countries. The account from which we select is that of Alfonso Borelli, Professor of Mathematics in Catania.

From the fissure above mentioned, he says, there came a bright light. Six mouths opened in a line with it and emitted vast columns of smoke, accompanied by loud bellowings which could be heard forty miles off. Towards the close of the day a crater opened about a mile below the others, which ejected red-hot stones to a considerable distance, and afterward sand and ashes which

covered the country for a distance of sixty miles. The new crater soon vomited forth a torrent of lava which presented a front of two miles; it encircled Monpiliéri, and afterward flowed towards Belpasso, a town of 8,000 inhabitants, which was speedily destroyed. Seven mouths of fire opened around the new crater, and in three days united with it, forming one large crater 800 feet in diameter. All this time the torrent of lava continued to descend, it destroying the town of Mascalucia on the 23d of March. On the same day the crater cast up great quantities of sand, ashes and scorix, and formed above itself the great double-coned hill now called Monté Rossi, from the red color of the ashes of which it is mainly composed.

VILLAGES AND CITIES BURIED

On the 25th very violent earthquakes occurred, and the cone above the great central crater was shaken down into the crater for the fifth time since the first century A. D. The original current of lava divided into three streams, one of which destroyed San Pietro, the second Camporotondo, and the third the lands about Mascalucia and afterward the village of Misterbianco. Fourteen villages were altogether destroyed, and the lava flowed toward Catania. At Albanelli, two miles from the city, it undermined a hill covered with cornfields and carried it forward a considerable distance. A vineyard was also seen to be floating on its fiery surface. When the lava reached the walls of Catania, it accumulated without progression until it rose to the top of the wall, 60 feet in height, and it then fell over in a fiery cascade and overwhelmed a part of the city. Another portion of the same stream threw down 120 feet of the wall and flowed into the city.

On the 23d of April the lava reached the sea, which it entered as a stream 600 yards broad and 40 feet deep. The stream had

moved at the rate of thirteen miles in twenty days, but as it cooled it moved less quickly, and during the last twenty-three days of its course, it advanced only two miles. On reaching the sea the water, of course, began to boil violently, and clouds of steam arose, carrying with them particles of scorix. Towards the end of April the stream on the west side of Catania, which had appeared to be consolidated, again burst forth, and flowed into the garden of the Benedictine Monastery of San Niccola, and then branched off into the city. Attempts were made to build walls to arrest its progress.

An attempt of another kind was made by a gentleman of Catania, named Pappalardo, who took fifty men with him, having previously provided them with skins for protection from the intense heat and with crowbars to effect an opening in the lava. They pierced the solid outer crust of solidified lava, and a rivulet of the molten interior immediately gushed out and flowed in the direction of Paterno, whereupon 500 men of that town, alarmed for its safety, took up arms and caused Pappalardo and his men to desist. The lava did not altogether stop for four months, and two years after it had ceased to flow it was found to be red hot beneath the surface. Even eight years after the eruption quantities of steam escaped from the lava after a shower of rain.

THE STONES EJECTED

The stones which were ejected from the crater during this eruption were often of considerable magnitude, and Borelli calculated that the diameter of one which he saw was 50 feet; it was thrown to a distance of a mile, and as it fell it penetrated the earth to a depth of 23 feet. The volume of lava emitted during the eruption amounted to many millions of cubic feet. Ferrara considers that the length of the stream was at least fifteen miles,

while its average width was between two and three miles, so that it covered at least forty square miles of surface.

Among the towns overflowed by this great eruption was Mompilieri. Thirty-five years afterward, in 1704, an excavation was made on the site of the principal church of this place, and at the depth of thirty-five feet the workmen came upon the gate, which was adorned with three statues. From under an arch which had been formed by the lava, one of these statues, with a bell and some coins, were extracted in good preservation. This fact is remarkable; for in a subsequent eruption, which happened in 1766, a hill about fifty feet in height, being surrounded on either side by two streams of lava, was in a quarter of an hour swept along by the current. The latter event may be explained by supposing that the hill in question was cavernous in its structure, and that the lava, penetrating into the cavities, forced asunder their walls, and so detached the superincumbent mass from its supports.

It is not by its streams of fire alone that Etna ravages the valleys and plains at its base. It sometimes also deluges them with great floods of water. On the 2d of March, 1755, two streams of lava, issuing from the highest crater, were at once precipitated on an enormous mass of very deep snow, which then clothed the summit. These fiery currents ran through the snow to a distance of three miles, melting it as they flowed. The consequence was, that a tremendous torrent of water rushed down the sides of the mountain, carrying with it vast quantities of sand, volcanic cinders and blocks of lava, with which it overspread the flanks of the mountain and the plains beneath, which it devastated in its course.

The volume of water was estimated at 16,000,000 cubic feet, it forming a channel two miles broad and in some places thirty-four feet deep, and flowing at the rate of two-thirds of a mile in a minute.

All the winter's snow on the mountain could not have yielded such a flood, and Lyell considered that it melted older layers of ice which had been preserved under a covering of volcanic dust.

ETNA IN 1819

Another great eruption took place in 1819, which presented some peculiarities. Near the point whence the highest stream of lava issued in 1811, there were opened three large mouths, which, with loud explosions, threw up hot cinders and sand, illuminated by a strong glare from beneath. Shortly afterwards there was opened, a little lower down, another mouth, from which a similar eruption took place; and still farther down there soon appeared a fifth, whence there flowed a torrent of lava which rapidly spread itself over the Val del Bove. During the first forty-eight hours it flowed nearly four miles, when it received a great accession. The three original mouths became united into one large crater, from which, as well as from the other two mouths below, there poured forth a vastly augmented torrent of lava, which rushed with great impetuosity down the same valley.

During its progress over this gentle slope, it acquired the usual crust of hardened slag. It directed its course towards that point at which Val del Bove opens into the narrow ravine beneath it—there being between the two a deep and almost perpendicular precipice. Arrived at this point, the lava-torrent leaped over the precipice in a vast cascade, and with a thundering noise, arising chiefly from the crashing and breaking up of the solid crust, which was in a great measure pounded to atoms by the fall; it throwing up such vast clouds of dust as to awaken an alarm that a fresh eruption had begun at this place, which is within the wooded region.

A very violent eruption, which lasted more than nine months, commenced on the 21st of August, 1852. It was first witnessed by a party of English tourists, who were ascending the mountain from Nicolosi in order to see the sunrise from the summit. As they approached the Casa Inglesi the crater commenced to give forth ashes and flames of fire. In a narrow defile they were met by a violent hurricane, which overthrew both the mules and their riders, and urged them toward the precipices of the Val del Bove. They sheltered themselves beneath some masses of lava, when suddenly an earthquake shook the mountain, and their mules in terror fled away. As day approached they returned on foot to Nicolosi, fortunately without having sustained injury. In the course of the night many *bocche del fuoco* (small lava vents) opened in that part of the Val del Bove called the Bazo di Trifoglietto, a great fissure opened at the base of the Giannicola Grande, and a crater was thrown up from which for seventeen days showers of sand and scorix were ejected.

EFFECT OF THE ERUPTION

During the next day a quantity of lava flowed down the Val del Bove, branching off so that one stream advanced to the foot of Monte Finocchio, and the other to Monte Calanna. Afterwards it flowed towards Zaffarana, and devastated a large tract of wooded region. Four days later a second crater was formed near the first, from which lava was emitted, together with sand and scorix, which caused cones to arise around the craters. The lava moved but slowly, and towards the end of August it came to a stand, only a quarter of a mile from Zaffarana.

On the second of September, Gemellaro ascended Monte Finocchio in the Val del Bove in order to witness the outburst. He states that the hill was violently agitated, like a ship at sea.

The surface of the Val del Bove appeared like a molten lake; scorïæ were thrown up from the craters to a great height, and loud explosions were heard at frequent intervals. The eruption continued to increase in violence. On October 6 two new mouths opened in the Val del Bove, emitting lava which flowed towards the valley of Calanna, and fell over the Salto della Giumenta, a precipice nearly 200 feet deep. The noise which it produced was like that of a clash of metallic masses. The eruption continued with abated violence during the early months of 1853, and it did not finally cease till May 27. The entire mass of lava ejected is estimated to have been equal to an area six miles long by two miles broad, with an average depth of about twelve feet.

This eruption was one of the grandest of all the known eruptions of Etna. During its outflow more than 2,000,000,000 cubic feet of molten lava was spread out over a space of three square miles. There have been several eruptions since its date, but none of marked prominence, though the mountain is rarely quiescent for any lengthened period.

THE LIPARI VOLCANOES

South-eastward of Ischia, between Calabria and Sicily, the Lipari Islands arrest attention for the volcanic phenomena they present. On one of these is Mount Vulcano, or Volcano, from which all this class of mountains is named. At present the best known of the Lipari volcanoes is Stromboli, which consists of a single mountain, having a very obtuse conical form. It has on one side of it several small craters, of which only one is at present in a state of activity.

The total height of the mountain is about 2000 feet, and the principal crater is situated at about two-thirds of the height. Stromboli is one of the most active volcanoes in the world. It is

mentioned as being in a state of activity by several writers before the Christian era, and the commencement of its operations extends into the past beyond the limits of tradition. Since history began its action has never wholly ceased, although it may have varied in intensity from time to time.

It has been observed that the violence of its eruptive force has a certain dependence on the weather—being always most intense when the barometer is lowest. From the position of the crater, it is possible to ascend the mountain and look down upon it from above. Even when viewed in this manner, it presents a very striking appearance. While there is an uninterrupted continuance of small explosions, there is a frequent succession of more violent eruptions, at intervals varying in length from seven to fifteen minutes.

HOFFMAN AT STROMBOLI

Several eminent observers have approached quite close to the crater, and examined it narrowly. One of these was M. Hoffman, who visited it in 1828.

This eminent geologist, while having his legs held by his companions, stretched his head over the precipice, and, looking right down into the mouth of one of the vents of the crater immediately under him, watched the play of liquid lava within it. Its surface resembled molten silver, and was constantly rising and falling at regular intervals. A bubble of white vapor rose and escaped, with a decrepitating noise, at each ascent of the lava—tossing up red-hot fragments of scoria, which continued dancing up and down with a sort of rhythmic play upon the surface. At intervals of fifteen minutes or so, there was a pause in these movements. Then followed a loud report, while the ground trembled, and there rose to the surface of the lava an immense bubble of vapor. This,

bursting with a crackling noise, threw out to the height of about 1200 feet large quantities of red-hot stones and scoriæ, which, describing parabolic curves, fell in a fiery shower all around. After another brief repose, the more moderate action was resumed as before.

Lipari, a neighboring volcano, was formerly more active than Stromboli, though for centuries past it has been in a state of complete quiescence. The Island of Volcano lies south of Lipari. Its crater was active before the Christian era, and still emits sulphurous and other vapors. At present its main office is to serve as a sulphur mine. Thus the peak which gives title to all fire-breathing mountains has become a servant to man. So are the mighty fallen !

CHAPTER XVIII.

Skaptar Jökull and Hecla, the Great Icelandic Volcanoes.

THE far-northern island of Iceland, on the verge of the frozen Arctic realm, is one of the most volcanic countries in the world, whether we regard the number of volcanoes concentrated in so small a space, or the extraordinary violence of their eruptions. Of volcanic mountains there are no less than twenty which have been active during historical times. Skaptar in the north, and Hecla in the south, being much the best known. In all, twenty-three eruptions are on record.

Iceland's volcanoes rival Mount Ætna in height and magnitude, their action has been more continuous and intense, and the range of volcanic products is far greater than in Sicily. The latter island, indeed, is not one-tenth of volcanic origin, while the whole of Iceland is due to the work of subterranean forces. It is entirely made up of volcanic rocks, and has seemingly been built up during the ages from the depths of the seas. It is reported, indeed, that a new island, the work of volcanic forces, appeared opposite Mount Hecla in 1563; but this statement is open to doubt.

VOLCANOES IN ICELAND

The eruptions of the volcanoes in Iceland have been amongst the most terrible of those carefully recorded. The cold climate of the island and the height of the mountains produce vast quantities of snow and ice, which cover the volcanoes and fill up the cracks

and valleys in their sides. When, therefore, an eruption commences, the intense heat of the boiling lava, and of the steam which rushes forth from the crater, makes the whole mountain hot, and vast masses of ice, great fields of snow, and deluges of water roll down the hill-sides into the plains. The lava pours from the top and from cracks in the side of the mountain, or is ejected hundreds of feet, to fall amongst the ice and snow; and the great masses of red-hot stone cast forth, accompanied by cinders and fine ashes, splash into the roaring torrent, which tears up rocks in its course and devastates the surrounding country for miles.

DREADFUL FLOODS

An eruption of Kotlugja, in 1860, was accompanied by dreadful floods. It began with a number of earthquakes, which shook the surrounding country. Then a dark columnar cloud of vapor was seen to rise by day from the mountain, and by night balls of fire (volcanic bombs) and red-hot cinders to the height of 24,000 feet (nearly five miles), which were seen at a distance of 180 miles. Deluges of water rushed from the heights, bearing along whole fields of ice and rocky fragments of every size, some vomited from the volcano, but in great part torn from the flanks of the mountain itself and carried to the sea, there to add considerably to the coastline after devastating the intervening country. The fountain of volcanic bombs consisted of masses of lava, containing gases which exploded and produced a loud sound, which was said to have been heard at a distance of 100 miles. The size of the bombs, and the height to which they must have reached, were very great. But the most remarkable of the historical eruptions in Iceland were those of Skaptar Jökull in 1783, and of Hecla in 1845. Of these an extended description is worthy of being given.

Of these two memorable eruptions, that of Skaptar-Jökull began on the 11th of June, 1783. It was preceded by a long series of earthquakes, which had become exceedingly violent immediately before the eruption. On the 8th, volcanic vapors were emitted from the summit of the mountain, and on the 11th immense torrents of lava began to be poured forth from numerous mouths. These torrents united to form a large stream, which, flowing down into the river Skapta, not only dried it up, but completely filled the vast gorge through which the river had held its course. This gorge, 200 feet in breadth, and from 400 to 600 feet in depth, the lava filled so entirely as to overflow to a considerable extent the fields on either side. On issuing from this ravine, the lava flowed into a deep lake which lay in the course of the river. Here it was arrested for a while; but it ultimately filled the bed of the lake altogether—either drying up its waters, or chasing them before it into the lower part of the river's course. Still forced onward by the accumulation of molten lava from behind, the stream resumed its advance, till it reached some ancient volcanic rocks which were full of caverns. Into these it entered, and where it could not eat its way by melting the old rock, it forced a passage by shivering the solid mass and throwing its broken fragments into the air to a height of 150 feet.

A TORRENT OF LAVA

On the 18th of June there opened above the first mouth a second of large dimensions, whence poured another immense torrent of lava, which flowed with great rapidity over the solidified surface of the first stream, and ultimately combined with it to form a more formidable main current. When this fresh stream reached the fiery lake, which had filled the lower portion of the valley of the Skapta, a portion of it was forced up the channel of that river,

towards the foot of the hill whence it takes its rise. After pursuing its course for several days, the main body of this stream reached the edge of a great waterfall called Stapafoss, which plunged into a deep abyss. Displacing the water, the lava here leaped over the precipice, and formed a great cataract of fire. After this, it filled the channel of the river, though extending itself in breadth far beyond it, and followed it until it reached the sea.

ENORMOUS QUANTITY OF LAVA

The 3rd of August brought fresh accessions to the flood of lava still pouring from the mountain. There being no room in the channel, now filled by the former lurid stream, which had pursued a northwesterly course, the fresh lava was forced to take a new direction towards the southeast, where it entered the bed of another river with a barbaric name. Here it pursued a course similar to that which flowed through the channel of the Skapta, filling up the deep gorges, and then spreading itself out into great fiery lakes over the plains.

The eruptions of lava from the mountain continued, with some short intervals, for two years, and so enormous was the quantity poured forth during this period that, according to a careful estimate which has been made, the whole together would form a mass equal to that of Mont Blanc. Of the two streams, the greater was fifty, the less forty, miles in length. The Skapta branch attained on the plains a breadth varying from twelve to fifteen miles—that of the other was only about half as much. Each of the currents had an average depth of 100 feet, but in the deep gorges it was no less than 600 feet. Even as late as 1794 vapors continued to rise from these great streams, and the water contained in the numerous fissures formed in their crust was hot.

The devastation directly wrought by the lava currents themselves was not the whole of the evils they brought upon unfortunate Iceland and its inhabitants. Partly owing to the sudden melting of the snows and glaciers of the mountain, partly owing to the stoppage of the river courses, immense floods of water deluged the country in the neighborhood, destroying many villages and a large amount of agricultural and other property. Twenty villages were overwhelmed by the lava currents, while the ashes thrown out during the eruption covered the whole island and the surface of the sea for miles around its shores. On several occasions the ashes were drifted by the winds over considerable parts of the European continent, obscuring the sun and giving the sky a gray and gloomy aspect. In certain respects they reproduced the phenomena of the explosion of Mount Krakatoa, which, singularly, occurred just a century later, in 1883. The strange red sunset phenomena of the latter were reproduced by this Icelandic event of the eighteenth century.

Out of the 50,000 persons who then inhabited Iceland, 9,336 perished, together with 11,460 head of cattle, 190,480 sheep and 28,000 horses. This dreadful destruction of life was caused partly by the direct action of the lava currents, partly by the noxious vapors they emitted, partly by the floods of water, partly by the destruction of the herbage by the falling ashes, and lastly in consequence of the desertion of the coasts by the fish, which formed a large portion of the food of the people.

ERUPTION OF MOUNT HECLA

After this frightful eruption, no serious volcanic disturbance took place in Iceland untill 1845, when Mount Hecla again became disastrously active. Mount Hecla has been the most frequent in its

eruptions of any of the Icelandic volcanoes. Previous to 1845 there had been twenty-two recorded eruptions of this mountain, since the discovery of Iceland in the ninth century; while from all the other volcanoes in the island there had been only twenty during the same period. Hecla has more than once remained in activity for six years at a time—a circumstance that has rendered it the best known of the volcanoes of this region.

LATER OUTBREAKS

After enjoying a long rest of seventy-nine years, this volcano burst again into violent activity in the beginning of September, 1845. The first inkling of this eruption was conveyed to the British Islands by a fall of volcanic ashes in the Orkneys, which occurred on the night of September 2nd during a violent storm. This palpable hint was soon confirmed by direct intelligence from Copenhagen. On the 1st of September a severe earthquake, followed the same night by fearful subterranean noises, alarmed the inhabitants and gave warning of what was to come. About noon the next day, with a dreadful crash, there opened in the sides of the volcano two new mouths, whence two great streams of glowing lava poured forth. They fortunately flowed down the northern and northwestern sides of the mountain, where the low grounds are mere barren heaths, affording a scanty pasture for a few sheep. These were driven before the fiery stream, but several of them were burnt before they could escape. The whole mountain was enveloped in clouds of volcanic ashes and vapors. The rivers near the lava currents became so hot as to kill the fish, and to be impassable even on horseback.

About a fortnight later there was a fresh eruption, of greater violence, which lasted twenty-two hours, and was accompanied by

detonations so loud as to be heard over the whole island. Two new craters were formed, one on the southern, the other on the eastern slope of the cone. The lava issuing from these craters flowed to a distance of more than twenty-two miles. At about two miles from its source the fiery stream was a mile wide, and from 40 to 50 feet deep. It destroyed a large extent of fine pasture and many cattle. Nearly a month later, on the 15th of October, a fresh flood of lava burst from the southern crater, and soon heaped up a mass at the foot of the mountain from 40 to 60 feet in height, three great columns of vapor, dust and ashes rising at the same time from the three new craters of the volcano. The mountain continued in a state of greater or less activity during most of the next year; and even as late as the month of October, 1846, after a brief pause, it began again with renewed vehemence. The volumes of dust, ashes and vapor, thrown up from the craters, and brightly illuminated by the glowing lava beneath, assumed the appearance of flames, and ascended to an immense height.

ELECTRIC PHENOMENA

Among the stones tossed out of the craters was one large mass of pumice weighing nearly half a ton, which was carried to a distance of between four and five miles. The rivers were flooded by the melting of ice and snow which had accumulated on the mountain. The greatest mischief wrought by these successive eruptions was the destruction of the pasturages, which were for the most part covered with volcanic ashes. Even where left exposed, the herbage acquired a poisonous taint which proved fatal to the cattle, inducing among them a peculiar murrain. Fortunately, owing to the nature of the district through which the lava passed, there was on this occasion no loss of human life.

The Icelandic volcanoes are remarkable for the electric phenomena which they produce in the atmosphere. Violent thunder-storms, with showers of rain and hail, are frequent accompaniments of volcanic eruptions everywhere; but owing to the coldness and dryness of the air into which the vapors from the Icelandic volcanoes ascend, their condensation is so sudden and violent that great quantities of electricity are developed. Thunder-storms accompanied by the most vivid lightnings are the result. Humboldt mentions in his "Cosmos" that, during an eruption of Kotlugja, one of the southern Icelandic volcanoes, the lightning from the cloud of volcanic vapor killed eleven horses and two men (Cosmos i. 223). Great displays of the aurora borealis usually accompany the volcanic eruptions of this island—doubtless resulting from the quantity of electricity imparted to the higher atmosphere by the condensation of the ascending vapors. On the 18th of August, 1783, while the great eruption of Skaptar Jökull was in progress, an immense fire-ball passed over England and the European continent as far as Rome. This ball which was estimated to have had a diameter exceeding half a mile, is supposed to have been of electrical origin, and due to the high state of electric tension in the atmosphere over Iceland at that time.

Volcanoes of the Philippines and Other Pacific Islands.

WE cannot do better than open this chapter with an account of the work of volcanoes in the mountain-girdled East Indian island of Java. This large and fertile tropical island has a large native population, and many European settlers are employed in cultivating spices, coffee and woods. The island is rather more than 600 miles long, and it is not 150 miles broad in any part; and this narrow shape is produced by a chain of volcanoes which runs along it. There is scarcely any other region in the world where volcanoes are so numerous, even in the East, where the volcano is a very common product of nature. Some of the volcanoes of Java are constantly in eruption, while others are inactive.

One of their number, Galung Gung, was previous to 1822 covered from top to bottom with a dense forest; around it were populous villages. The mountain was high; there was a slight hollow on its top—a basin-like valley, carpeted with the softest sward; brooks rippled down the hillside through the forests, and, joining their silvery streams, flowed on through beautiful valleys into the distant sea. In the month of July, 1822, there were signs of an approaching disturbance; this tranquil peacefulness was at an end; one of the rivers became muddy, and its waters grew hot.

In October, without any warning, a most terrific eruption occurred. A loud explosion was heard; the earth shook, and

immense columns of hot water, boiling mud mixed with burning brimstone, ashes and stones, were hurled upwards from the mountain top like a waterspout, and with such wonderful force that large quantities fell at a distance of forty miles. Every valley near the mountain became filled with burning torrents; the rivers, swollen with hot water and mud, overflowed their banks, and swept away the escaping villagers; and the bodies of cattle, wild beasts, and birds were carried down the flooded stream.

ERUPTION OF GALUNG GUNG

A space of twenty-four miles between the mountain and a river forty miles distant was covered to such a depth with blue mud, that people were buried in their houses, and not a trace of the numerous villages and plantations was visible. The boiling mud and cinders were cast forth with such violence from the crater, that while many distant villages were utterly destroyed and buried, others much nearer the volcano were scarcely injured; and all this was done in five short hours.

Four days afterwards a second eruption occurred more violent than the first, and hot water and mud were cast forth with masses of slag like the rock called basalt some of which fell seven miles off. A violent earthquake shook the whole district, and the top of the mountain fell in, and so did one of its sides, leaving a gaping chasm. Hills appeared where there had been level land before, and the rivers changed their courses, drowning in one night 2,000 people. At some distance from the mountain a river runs through a large town, and the first intimation the inhabitants had of all this horrible destruction was the news that the bodies of men and the carcases of stags, rhinoceroses, tigers, and other animals, were rushing along to the sea. No less than 114 villages were destroyed, and above 4,000 persons were killed by this terrible catastrophe.

Fifty years before this eruption, Mount Papandayang, one of the highest burning mountains of Java, was constantly throwing out steam and smoke, but as no harm was done, the natives continued to live on its sides. Suddenly this enormous mountain fell in, and left a gap fifteen miles long and six broad. Forty villages were destroyed, some being carried down and others overwhelmed by mud and burning lava. No less than 2,957 people perished, with vast numbers of cattle ; moreover, most of the coffee plantations in the neighboring districts were destroyed.

Even more terrible was the eruption of Mount Salek, another of the volcanoes of Java. The burning of the mountain was seen 100 miles away, while the thunders of its convulsions and the tremblings of the earth reached the same distance. Seven hills, at whose base ran a river—crowded with dead buffaloes, deer, apes, tigers, and crocodiles—slipped down and became a level plain. River-courses were changed, forests were burnt up, and the whole face of the country was completely altered.

Later volcanic eruptions in Java include that of 1843, when Mount Guntur flung out sand and ashes estimated at the vast total of thirty million tons, and those of 1849 and 1872 when Mount Merapi, a very active volcano, covered a great extent of country with stones and ashes, and ruined the coffee plantations of the neighboring districts.

We have said nothing concerning the most terrible explosion of all, that of the volcanic island of Krakatoa, off the Javan coast. This event was so phenomenal as to deserve a chapter of its own, for which we reserve it.

The United States, as one result of its recent acquisition of island dominions, has added largely to its wealth in volcanic mountains. The famous Hawaiian craters, far the greatest in the world,

now belong to our national estate, and the Philippine Islands contain various others, of less importance, yet some of which have proved very destructive. A description of those of the Island of Luzon, which are the most active in the archipelago, is here subjoined :

THE LUZON VOLCANOES.

Volcanoes have played an important part in the formation of the Philippine Islands and have left traces of their former activity in all directions. Most of them, however, have long been dead and silent, only a few of the once numerous group being now active. Of these there are three of importance in the southern region of Luzon—Taal, Bulusan and Mayon or Albay.

The last named of these is the largest and most active of the existing volcanoes. In form it is of marvellous grace and beauty, forming a perfect cone, about fifty miles in circuit at base and rising to a height of 8,900 feet. It is one of the most prominent landmarks to navigators in the island. From its crater streams upward a constant smoke, accompanied at times by flame, while from its depths issue subterranean sounds, often heard at a distance of many leagues. The whole surrounding country is marked by evidences of old eruptions.

This mountain, in 1767, sent up a cone of flame of forty feet in diameter at base, for ten days, and for two months a wide stream of lava poured from its crater. A month later there gushed forth great floods of water, which filled the rivers to overflow, doing widespread damage to the neighboring plantations. But its greatest and most destructive eruption took place in 1812, the year of the great eruption of the St. Vincent volcano. On this fatal occasion several towns were destroyed and no less than 12,000 people lost their lives. The debris flung forth from the crater were so abundant

that deposits deep enough to bury the tallest trees were formed near the mountain. In 1867 another disastrous explosion took place, and still another in 1888. A disaster different in kind and cause occurred in 1876, when a terrible tropical storm burst upon the mountain. The floods of rain swept from its sides the loose volcanic material, and brought destruction to the neighboring country, more than six thousand houses being ruined by the rushing flood.

BULUSAN AND TAAL

Bulusan, a volcano on the southern extremity of the island, resembles Vesuvius in shape. For many years it remained dormant, but in 1852 smoke began to issue from its crater. In some respects the most interesting of these three volcanoes is that of Taal, which lies almost due south of Manila and about forty-five miles distant, on a small island in the middle of a large lake, known as Bombom or Bongbong. A remarkable feature of this volcanic mountain is that it is probably the lowest in the world, its height being only 850 feet above sea level. There are doubtful traditions that Lake Bombom, a hundred square miles in extent, was formed by a terrible eruption in 1700, by which a lofty mountain 8000 or 9000 feet high, was destroyed. The vast deposits of porous tufa in the surrounding country are certainly evidences of former great eruptions from Mount Taal.

The crater of this volcano is an immense, cup-shaped depression, a mile or more in diameter and about 800 feet deep. When recently visited by Professor Worcester, during his travels in these islands, he found it to contain three boiling lakelets of strangely-colored water, one being of a dirty brown hue, a second intensely yellow in tint, and the third of a brilliant emerald green. The mountain still steams and fumes, as if too actively at work below

to be at rest above. In past times it has shown the forces at play in its depths by breaking at times into frightful activity. Of the various explosions on record, the three most violent were those of 1716, 1749, and 1754. In the last-named year the earth for miles round quaked with the convulsive throes of the deeply disturbed mountain, and vast quantities of volcanic dust were hurled high into the air, sufficient to make it dark at midday for many leagues around. The roofs of distant Manila were covered with volcanic dust and ashes. Molten lava also poured from the crater and flowed into the lake, which boiled with the intense heat, while great showers of stones and ashes fell into its waters.

VOLCANOES IN THE SOUTHERN ISLANDS

Extinct volcanoes are numerous in Luzon, and there are smoking cones in the north, and also in the Babuyan Islands still farther north. Volcanoes also exist in several of the other islands. On Negros is the active peak of Malaspina, and on Camiguin, an island about ninety miles to the southeast, a new volcano broke out in 1876. The large island of Mindanao has three volcanoes, of which Cottabato was in eruption in 1856 and is still active at intervals. Apo, the largest of the three, estimated to be 10,312 feet high, has three summits, within which lies the great crater, now extinct and filled with water.

In evidence of former volcanic activity are the abundant deposits of sulphur on the island of Leyte, the hot springs in various localities, and the earthquakes which occasionally bring death and destruction. Of the many of these on record, the most destructive was in 1863, when 400 people were killed and 2,000 injured, while many buildings were wrecked. Another in 1880 wrought great destruction in Manila and elsewhere, though without loss of life.

An earthquake in Mindanao in 1675 opened a passage to the sea, and a vast plain emerged. These convulsions of the earth affect the form and elevation of buildings, which are rarely more than two stories high and lightly built, while translucent sea-shells replace glass in their windows.

While Java is the most prolific in volcanoes of the islands of the Malayan Archipelago, other islands of the group possess active cones, including Sumatra, Bali, Amboyna, Banda and others. In Sanguir, an island north of Celebes, is a volcanic mountain from which there was a destructive eruption in 1856. The country was devastated with lava, stones and volcanic ashes, ruining a wide district and killing nearly 3,000 of the inhabitants. Mount Madrian, in one of the Spice Islands, was rent in twain by a fierce eruption in 1646, and since then has remained two distinct mountains. It became active again in 1862, after two centuries of repose, and caused great loss of life and property. Sorea, a small island of the same group, forming but a single volcanic mountain, had an eruption in 1693, the cone crumbling gradually till a vast crater was formed, filled with liquid lava and occupying nearly half the island. This lake of fire increased in size by the same process till in the end it took possession of the island and forced all the inhabitants to flee to more hospitable shores.

THE GREAT ERUPTION OF TOMBORO

But of the East Indian Islands, Sumbawa, lying east of Java, contains the most formidable volcano—one, indeed, scarcely without a rival in the world. This is named Tomboro. Of its various eruptions the most furious on record was that of 1815. This, as we are told by Sir Stamford Raffles, far exceeded in force and duration any of the known outbreaks of Etna or Vesuvius. The

ground trembled and the echoes of its roar were heard through an area of 1,000 miles around the volcano, and to a distance of 300 miles its effects were astounding.

In Java, 300 miles away, ashes filled the air so thickly that the solar rays could not penetrate them, and fell to the depth of several inches. The detonations were so similar to the reports of artillery as to be mistaken for them. The Rajah of Sang'ir, who was an eye-witness of the eruption, thus described it to Sir Stamford :

“About 7 P. M. on the 10th of April, three distinct columns of flame burst forth near the top of the Tomboro mountain (all of them apparently within the verge of the crater), and, after ascending separately to a very great height, their tops united in the air in a troubled, confused manner. In a short time the whole mountain next Sang'ir appeared like a body of liquid fire, extending itself in every direction. The fire and columns of flame continued to rage with unabated fury, until the darkness caused by the quantity of falling matter obscured them, at about 8 P. M. Stones at this time fell very thick at Sang'ir—some of them as large as two fists, but generally not larger than walnuts. Between 9 and 10 P. M. ashes began to fall, and soon after a violent whirlwind ensued, which blew down nearly every house in the village of Sang'ir—carrying the roofs and light parts away with it. In the port of Sang'ir, adjoining Tomboro, its effects were much more violent—tearing up by the roots the largest trees, and carrying them into the air, together with men, horses, cattle, and whatever else came within its influence. This will account for the immense number of floating trees seen at sea. The sea rose nearly twelve feet higher than it had ever been known to do before, and completely spoiled the only spots of rice-land in Sang'ir—sweeping away houses and everything within its reach. The whirlwind lasted about an hour.

No explosions were heard till the whirlwind had ceased, at about 11 P. M. From midnight till the evening of the 11th, they continued without intermission. After that time their violence moderated, and they were heard only at intervals; but the explosions did not cease entirely until the 15th of July. Of all the villages of Tomboro, Tempo, containing about forty inhabitants, is the only one remaining. In Pekate no vestige of a house is left; twenty-six of the people, who were at Sumbawa at the time, are the whole of the population who have escaped. From the most particular inquiries I have been able to make, there were certainly no fewer than 12,000 individuals in Tomboro and Pekate at the time of the eruption, of whom only five or six survive. The trees and herbage of every description, along the whole of the north and west sides of the peninsula, have been completely destroyed, with the exception of those on a high point of land, near the spot where the village of Tomboro stood."

Tomboro village was not only invaded by the sea on this occasion, but its site permanently subsided; so that there is now eighteen feet of water where there was formerly dry land.

THE VOLCANOES OF JAPAN

The Japanese archipelago, as stated in an earlier chapter, is abundantly supplied with volcanoes, a number of them being active. Of these the best known to travelers is Asamayama, a mountain 8,500 feet high, of which there are several recorded eruptions. The first of these was in 1650; after which the volcano remained feebly active till 1783, when it broke out in a very severe eruption. In 1870 there was another of some severity, accompanied by violent shocks of earthquake felt at Yokohama. The crater is very deep, with irregular rocky walls of a sulphurous character.

Far the most famous of all the Japanese mountains, however, is that named Fuji-san, but commonly termed in English Fujiyama or Fusi-yama. It is in the vicinity of the capital, and is the most prominent object in the landscape for many miles around. The apex is shaped somewhat like an eight-petaled lotus flower, and offers to view from different directions from three to five peaks.

Though now apparently extinct, it was formerly an active volcano, and is credited in history with several very disastrous eruptions. The last of these was in 1707, at which time the whole summit burst into flames. Rocks were split and shattered by the heat, and stones fell to the depth of several inches in Yeddo (now Tokyo), sixty miles away. At present there are in its crater, which has a depth of 700 or 800 feet, neither sulphurous exhalations nor steam. According to Japanese tradition this great peak was upheaved in a single night from the bottom of the sea, more than twenty-one hundred years ago.

Nothing can be more majestic than this volcano, extinct though it be, rising in an immense cone from the plain to the height of over twelve thousand feet, truncated at the top, and with its peak almost always snow-covered. Its ascent is not difficult to an expert climber, and has frequently been made. From its summit is unfolded a panorama beyond the power of words to describe, and probably the most remarkable on the globe. Mountains, valleys, lakes, forests and the villages of thirteen counties may be seen. As we gaze upon its beautifully shaped and lofty mass, visible even from Yokohama and a hundred miles at sea, one does not wonder that it should be regarded as a holy mountain, and that it should form a conspicuous object in every Japanese work of art. It is to the natives of Japan as Mont Blanc is to Europeans, the "monarch of mountains."

In summer pilgrimages are made around the base of the summit elevation, and there are on the upward path a number of Buddhist temples and shrines, made of blocks of stone, for devotion, shelter and the storage of food for pilgrims. Hakone Lake is three thousand feet above the sea, and probably lies in the crater of an extinct volcano. Its waters are very deep; it is several miles long and wide, and is surrounded by high hills which abound in fine scenery, solfataras and mineral springs.

HOT SPRINGS NEAR HAKONE LAKE

At this place the mountain seems to be smouldering, as sulphur fumes and steam issue at many points, and the ground is covered with a friable white alkaline substance. In many a hollow the water bubbles with clouds of vapor and sulphuretted hydrogen; here the soil is hot and evidently underlaid by active fires. It is not safe to go very near, as the crust is thin and crumbling. The water running down the hills has a refreshing sound and a tempting clearness, but the thirsty tongue at once detects it to be a very strong solution of alum. The whole aspect of the place is infernal, and naturally suggests the name given its principal geyser, O-gigoko (Big Hell).

Fujiyama is almost a perfect cone, with, as above said, a truncated top, in which is the crater. It is, however, less steep than Mayon. Its upper part is comparatively steep, even to thirty-five degrees, but below this portion the inclination gradually lessens, till its elegant outlines are lost in the plain from which it rises. The curves of the sides depend partly on the nature, size and shape of the ejected material, the fine uniform pieces remaining on comparatively steep slopes, while the larger and rounder ones roll farther down, resting on the inclination that afterward becomes curved from the subsidence of the central mass.

The most recent and one of the most destructive of volcanic eruptions recorded in Japan was that of Bandaisan or Baldaisan. For ages this mountain had been peaceful, and there was scarcely an indication of its volcanic character or of the terrific forces which lay dormant deep within its heart. On its flanks lay some small deposits of scoriæ, indications of far-past eruptions, and there were some hot springs at its base, while steam arose from a fissure. Yet there was nothing to warn the people of the vicinity that deadly peril lay under their feet.

BANDAISAN'S WORK OF TERROR

This sense of security was fatally dissipated on a day in July, 1888, when the mountain suddenly broke into eruption and flung 1,600 million cubic yards of its summit material so high into the air that many of the falling fragments, in their fall, struck the ground with such velocity as to be buried far out of sight. The steam and dust were driven to a height of 13,000 feet, where they spread into a canopy of much greater elevation, causing pitchy darkness beneath. There were from fifteen to twenty violent explosions, and a great landslide devastated about thirty square miles and buried many villages in the Nagase Valley.

Mr. Norman, a traveler who visited the spot shortly afterward, thus describes the scene of ruin. After a journey through the forests which clothed the slopes of the volcanic mountain and prevented any distant view, the travelers at last found themselves "standing upon the ragged edge of what was left of the mountain of Bandaisan, after two-thirds of it, including, of course, the summit, had been literally blown away and spread over the face of the country.

"The original cone of the mountain," he continues, "had been truncated at an acute angle to its axis. From our very feet a precipitous mud slope falls away for half a mile or more till it reaches the level. At our right, still below us, rises a mud wall a mile long, also sloping down to the level, and behind it is evidently the crater; but before us, for five miles in a straight line, and on each side nearly as far, is a sea of congealed mud, broken up into ripples and waves and great billows, and bearing upon its bosom a thousand huge boulders, weighing hundreds of tons apiece."

On reaching the crater he found it to resemble a gigantic cauldron, fully a mile in width, and enclosed with precipitous walls of indurated mud. From several orifices volumes of steam rose into the air, and when the vapor cleared away for a moment glimpses of a mass of boiling mud were obtained. Before the eruption the mountain top had terminated in three peaks. Of these the highest had an elevation of about 5,800 feet. The peak destroyed was the middle one, which was rather smaller than the other two.

"The explosion was caused by steam; there was neither fire nor lava of any kind. It was, in fact, nothing more nor less than a gigantic boiler explosion. The whole top and one side of Sho-Bandai-san had been blown into the air in a lateral direction, and the earth of the mountain was converted by the escaping steam, at the moment of the explosion, into boiling mud, part of which was projected into the air to fall at a long distance, and then take the form of an overflowing river, which rushed with vast rapidity and covered the country to a depth of from 20 to 150 feet. Thirty square miles of country were thus devastated."

In the devastated lowlands and buried villages below and on the slopes of the mountain many lives were lost. From the survivors Mr. Norman gathered some information, enabling him

to describe the main features of the catastrophe. We append a brief outline of his narrative :

MR. NORMAN'S NARRATIVE

“At a few minutes past 8 o'clock in the morning a frightful noise was heard by the inhabitants of a village ten miles distant from the crater. Some of them instinctively took to flight, but before they could run much more than a hundred yards the light of day was suddenly changed into a darkness more intense than that of midnight ; a shower of blinding hot ashes and sand poured down upon them ; the ground was shaken with earthquakes, and explosion followed explosion, the last being the most violent of all. Many fugitives, as well as people in the houses, were overwhelmed by the deluge of mud, none of the fugitives, when overtaken by death, being more than two hundred yards from the village. From the statements made by those fortunate enough to escape with their lives, and from a personal examination of the ground, Mr. Norman inferred that the mud must have been flung fully six miles through the air and then have poured in a torrent along the ground for four miles further. All this was done in less than five minutes, so that “millions of tons of boiling mud were hurled over the country at the rate of two miles a minute.”

The velocity of the mud torrent may perhaps be overestimated, but in its awful suddenness this catastrophe was evidently one with few equals. The cone destroyed may have been largely composed of rather fine ashes and scoriæ, which was almost instantaneously converted into mud by the condensing steam and the boiling water ejected. The quantity of water thus discharged must have been enormous.

Of the remaining volcanic regions of the Pacific, the New Zealand islands present some of the most striking examples of activity. All the central parts, indeed, of the northern island of the group are of a highly volcanic character. There is here a mountain named Tongariro, on whose snow-clad summit is a deep crater, from which volcanic vapors are seen to issue, and which exhibits other indications of having been in a state of greater activity at a not very remote period of time. There is also, at no great distance from this mountain, a region containing numerous funnel-shaped chasms, emitting hot water, or steam, or sulphurous vapors, or boiling mud. The earthquakes in New Zealand had probably their origin in this volcanic focus.

THE NEW ZEALAND VOLCANOES

Tongariro has a height of about 6,500 feet, while Egmont, 8,270 feet in height, is a perfect cone with a perpetual cap of snow. There are many other volcanic mountains, and also great numbers of mud volcanoes, hot springs and geysers. It is for the latter that the island is best known to geologists. Their waters are at or near the boiling point and contain silica in abundance.

At a place called Rotomahana, in the vicinity of Mount Tarawera, there was formerly a lake of about one hundred and twenty acres in area, which was in its way one of the most remarkable bodies of water upon the earth. Formerly, we say, for this lake no longer exists, it having been destroyed by the very forces to which it owed its fame. Its waters were maintained nearly at the boiling point by the continual accession of boiling water from numerous springs. The most abundant of those sources was situated at the height of about 100 feet above the level of the lake. It kept continually filled an oval basin about 250 feet in circumference—the margins of

which were fringed all round with beautiful pure white stalactites, formed by deposits of silica, with which the hot water was strongly impregnated. At various stages below the principal spring were several others, that contributed to feed the lake at the bottom, in the centre of which was a small island. Minute bubbles continually escaped from the surface of the water with a hissing sound, and the sand all round the lake was at a high temperature. If a stick was thrust into it, very hot vapors would ascend from the hole. Not far from this lake were several small basins filled with tepid water, which was very clear, and of a blue color.

The conditions here were of a kind with those to which are due the great geysers of Iceland and the Yellowstone Park, but different in the fact that instead of being intermittent and throwing up jets at intervals, the springs allowed the water to flow from them in a continuous stream.

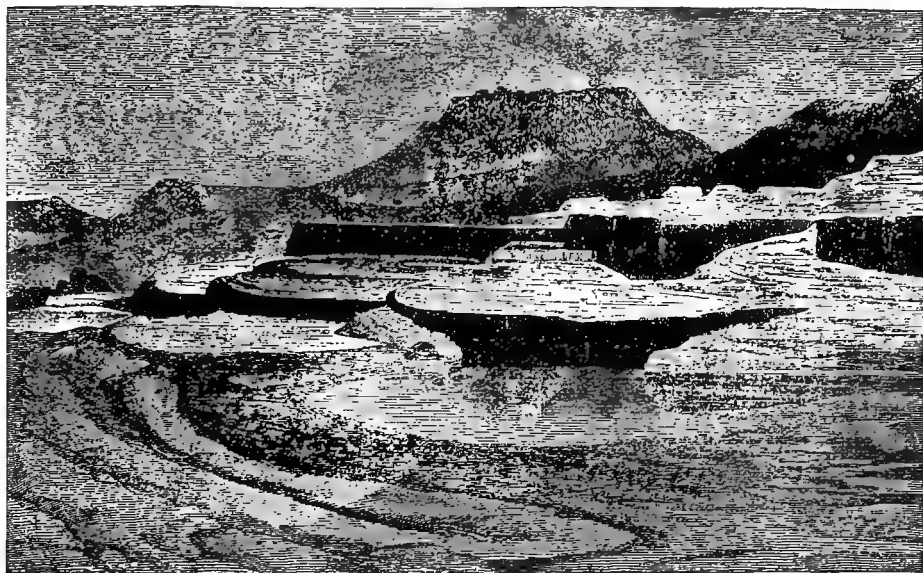
THE PINK AND WHITE TERRACES

The silicious incrustations left by the overflow from the large pool had made a series of terraces, two to six feet high, with the appearance of being hewn from white or pink marble; each of the basins containing a similar azure water. These terraces covered an area of about three acres, and looked like a series of cataracts changed into stone, each edge being fringed with a festoon of delicate stalactites. The water contained about eighty-five per cent. of silica, with one or two per cent. of iron alumina, and a little alkali.

There were no more beautiful products of nature upon the earth than those "pink and white terraces," as they were called. The hot springs of the Yellowstone have produced formations resembling them, but not their equal in fairy-like charm. One

series of these terraced pools and cascades was of the purest white tint, the other of the most delicate pink, the waters topping over the edge of each pool and falling in a miniature cascade to the one next below, thus keeping the edges built up by a continual renewal of the silicious incrustation. But all their beauty could not save them from utter and irremediable destruction by the forces below the earth's surface.

On June 9, 1886, a great volcanic disturbance began in the



PINK AND WHITE TERRACES OF LAKE ROTO MAHANA, NEW ZEALAND.

Auckland Lake region with a tremendous earthquake, followed during the night by many others: At seven the next morning a lead-covered cloud of pumice sand, advancing from the south, burst and discharged showers of fine dust. The range of Mount Tarawera seemed to be in full volcanic activity, including some craters supposed to be extinct, and embracing an area of one hundred and twenty miles by twenty.

The showers of dust were so thick as to turn day into night for nearly two days. Some lives were lost, and several villages were destroyed, these being covered ten feet deep with ashes, dust and clayey mud. The volcanic phenomena were of the most violent character, and the whole island appears to have been more or less convulsed. Mount Tarawera is said to be five hundred feet higher than before the eruption; glowing masses were thrown up into the air, and tongues of fiery hue, gases or illuminated vapors, five hundred feet wide, towered up one thousand feet high. The mountain was 2,700 feet in height.

TARAWERA IN ERUPTION

This eruption presented a spectacle of rarely-equalled grandeur. To travelers and strangers the greatest resultant loss will be the destruction of those world-famous curiosities, the white and pink terraces, in the vicinity of Lake Rotomahana and the region of the famous geysers. The natives have a superstition that the eruption of the extinct Tarawera was caused by the profanation of foreign footsteps. It was to them a sacred place, and its crater a repository for their dead. The first earthquake occurred in this region. One side of the mountain fell in, and then the eruption began. The basin of the lake was broken up and disappeared, but again reappeared as a boiling mud cauldron; craters burst out in various places, and the beautiful terraces were no more. After the first day the violence gradually diminished, and in a week had ceased. Very possibly another lake will be formed, and in time other terraces; but it is hardly within the range of probability that the beauty of the lost terraces will ever be paralleled.

In this eruption, as usual, we find the earthquake preceding the volcanic outburst. New Zealand, like the Philippines, Java and

the Japanese Islands, is situated over a great earth-fissure or line of weakness. Subsidence or dislocation from tensile strain of the crust took place, and the influx of water to new regions of heated strata may have developed the explosive force. The earthquake and the volcano worked together here, as they frequently do, unfortunately in this case destroying one of the most beautiful scenes on the surface of the globe.

THE ANTARCTIC VOLCANOES

Much further south, on the frozen shore of Victoria Land in the Antarctic regions, Sir James Ross, in 1841, sailing in his discovery ships the *Erebus* and *Terror*, discovered two great volcanic mountains, which he named after those two vessels. Mount Erebus is continually covered, from top to bottom, with snow and glaciers. The mountain is about 12,000 feet high, and although the snow reaches to the very edge of the crater, there rise continually from the summit immense volumes of volcanic fumes, illuminated by the glare of glowing lava beneath them. The vapors ascend to an estimated height of 2,200 feet above the top of the mountain.

CHAPTER XX.

The Wonderful Hawaiian Craters and Kilauea's Lake of Fire.

IN the central region of the North Pacific Ocean lies the archipelago formerly known as the Sandwich Islands, now collectively designated as Hawaii. The people of the United States should be specially interested in this island group, for it has become one of our possessions, an outlying Territory of our growing Republic, and in making it part of our national domain we have not alone extended our dominion far over the seas, but have added to the many marvels of nature within our land one of the chief wonders of the world, the stupendous Hawaiian volcanoes, before whose grandeur many of more ancient fame sink into insignificance.

THE ISLAND OF HAWAII

The Island of Hawaii, the principal island of the group, we may safely say contains the most enormous volcano of the earth. Indeed, the whole island, which is 4000 square miles in extent, may be regarded as of volcanic origin. It contains four volcanic mountains—Kohola, Hualalia, Mauna Kea and Mauna Loa. The two last named are the chief, the former being 13,800 feet, the latter 13,600 feet, above the sea-level. Although their height is so vast, the ascent to their summits is so gradual that their circumference at the base is enormous. The bulk of each of them is reckoned to be equal to two and a half times that of Etna. Some of the streams

of lava which have emanated from them are twenty-six miles in length by two miles in breadth.

On the adjoining island of Maui is a still larger volcano, the mighty Haleakala, long since extinct, but memorable as possessing the most stupendous crater on the face of the earth. The mountain itself is over 10,000 feet high, and forms a great dome-like mass of 90 miles circumference at base. The crater on its summit has a length of $7\frac{1}{2}$ and a width of $2\frac{1}{4}$ miles, with a total area of about sixteen square miles. The only approach in dimensions to this enormous opening exists in the still living crater of Kilauea, on the flank of Mauna Loa.

A VOLCANIC ISLAND GROUP

The peaks named are the most apparent remnants of a world-rending volcanic activity in the remote past, by whose force this whole Hawaiian island group was lifted up from the depths of the ocean, here descending some three and a half miles below the surface level. The coral reefs which abound around the islands are of comparatively recent formation, and rest upon a substratum of lava probably ages older, which forms the base of the archipelago. The islands are volcanic peaks and ridges that have been pushed up above the surrounding seas by the profound action of the interior forces of the earth.

It must not be supposed that this action was a violent perpendicular thrust upward over a very limited locality, for the mountains continue to slope at about the same angle under the sea and for great distances on every side, so that the islands are really the crests of an extensive elevation, estimated to cover an area of about 2000 miles in one direction by 150 or 200 miles in the other. The process was probably a gradual one of up-building, by means of

which the sea receded as the land steadily rose. Some idea of the mighty forces that have been at work beneath the sea and above it can be gained by considering the enormous mass of material now above the sea-level. Thus, the bulk of the island of Hawaii, the largest of the group, has been estimated by the Hawaiian Surveyor General as containing 3,600 cubic miles of lava rock above sea-level. Taking the area of England at 50,000 square miles, this mass of volcanic matter would cover that entire country to a depth of 274 feet. We must remember, however, that what is above sea-level is only a small fraction of the total amount, since it sweeps down below the waves hundreds of miles on every side.

CRATER OF HALEAKALA

Of the lava openings on these islands, the extinct one of Haleakala, as stated, with its twenty-seven miles circumference, is far the most stupendous. It is easy of access, the mountain sides leading to it presenting a gentle slope; while the walls of the crater, in places perpendicular, in others are so sloping that man and horse can descend them. The pit varies from 1500 to 2000 feet in depth, its bottom being very irregular from the old lava flows and the many cinder cones, these still looking as fresh as though their fires had just gone out. Some of these cones are over 500 feet high. There is a tradition among the natives that the vast lava streams which in the past flowed from the crater to the sea continued to do so in the period of their remote ancestors. They still, indeed, appear as if recent, though there are to-day no signs of volcanic activity anywhere on this island.

In fact, the only volcano now active in the Hawaiian Islands is Mauna Loa, in the southern section of the Island of Hawaii. A striking feature of this is that it has two distinct and widely discon-

nected craters, one on its summit, the other on its flank, at a much lower level. The latter is the vast crater of Kilauea, the largest active crater known on the face of the globe.

MISS BIRD IN THE CRATER OF KILAUEA

We cannot offer a better description of the aspect of this lava abyss than to give Miss Bird's eloquent description of her adventurous descent into it :

"The abyss, which really is at a height of four thousand feet on the flank of Mauna Loa, has the appearance of a pit on a rolling plain. But such a pit! It is quite nine miles in circumference, and at its lowest area—which not long ago fell about three hundred feet, just as the ice on a pond falls when the water below is withdrawn—covers six square miles. The depth of the crater varies from eight hundred to one thousand feet, according as the molten sea below is at flood or ebb. Signs of volcanic activity are present more or less throughout its whole depth and for some distance along its margin, in the form of steam-cracks, jets of sulphurous vapor, blowing cones, accumulating deposits of acicular crystals of sulphur, etc., and the pit itself is constantly rent and shaken by earthquakes. Great eruptions occur with circumstances of indescribable terror and dignity; but Kilauea does not limit its activity to these outbursts, but has exhibited its marvellous phenomena through all known time in a lake or lakes on the southern part of the crater three miles from this side.

"This lake—the *Hale-mau-mau*, or "House of Everlasting Fire", of the Hawaiian mythology, the abode of the dreaded goddess Pele—is approachable with safety, except during an eruption. The spectacle, however, varies almost daily; and at times the level of the lava in the pit within a pit is so low, and the suffocating

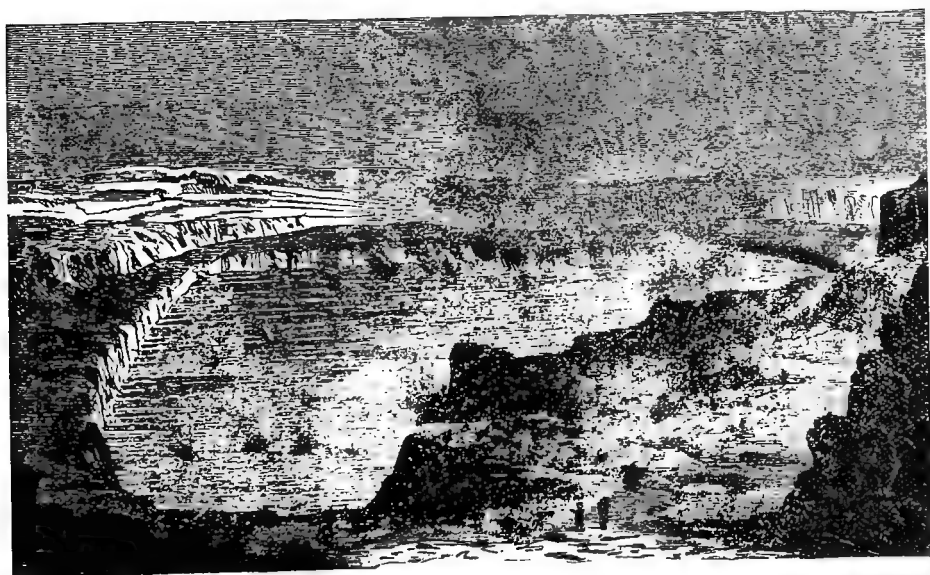
gases are evolved in such enormous quantities, that travellers are unable to see anything.

“At the time of our visit there had been no news from it for a week ; and as nothing was to be seen but a very faint bluish vapor hanging round its margin, the prospect was not encouraging. After more than an hour of very difficult climbing, we reached the lowest level of the crater, pretty nearly a mile across, presenting from above the appearance of a sea at rest ; but on crossing it, we found it to be an expanse of waves and convolutions of ashy-colored lava, with huge cracks filled up with black iridescent rolls of lava only a few weeks old. Parts of it are very rough and ridgy, jammed together like field-ice, or compacted by rolls of lava, which may have swelled up from beneath ; but the largest part of the area presents the appearance of huge coiled hawsers, the ropy formation of the lava rendering the illusion almost perfect. These are riven by deep cracks, which emit hot sulphurous vapors.

“As we ascended, the flow became hotter under our feet, as well as more porous and glistening. It was so hot that a shower of rain hissed as it fell upon it. The crust became increasingly insecure, and necessitated our walking in single file with the guide in front, to test the security of the footing. I fell through several times, and always into holes full of sulphurous steam so malignantly acid that my strong dogskin gloves were burned through as I raised myself on my hands.

“We had followed the lava-flow for thirty miles up to the crater's brink, and now we had toiled over recent lava for three hours, and, by all calculations, were close to the pit ; yet there was no smoke or sign of fire, and I felt sure that the volcano had died out for once for my special disappointment.

"Suddenly, just above and in front of us, gory drops were tossed in the air, and springing forwards, we stood on the brink of Hale-mau-mau, which was about thirty-five feet below us. I think we all screamed. I know we all wept; but we were speechless, for a new glory and terror had been added to the earth. It is the most unutterable of wonderful things. The words of common speech are quite useless. It is unimaginable, indescribable; a sight to



CRATER OF KILAUEA, HAWAII
Fiery Lake of Molten Lava

remember forever; a sight which at once took possession of every faculty of sense and soul, removing one altogether out of the range of ordinary life. Here was the real 'bottomless pit', 'the fire which is not quenched', 'the place of Hell', 'the lake which burneth with fire and brimstone', 'the everlasting burnings', 'the fiery sea whose waves are never weary'. Perhaps those Scripture phrases were suggested by the sight of some volcano in eruption.

There were groanings, rumblings, and detonations ; rushings, hissings, splashings, and the crashing sound of breakers on the coast ; but it was the surging of fiery waves upon a fiery shore. But what can I write ? Such words as jets, fountains, waves, spray, convey some idea of order and regularity, but here there are none.

“ The inner lake, while we stood there, formed a sort of crater within itself ; the whole lava sea rose about three feet ; a blowing cone about eight feet high was formed ; it was never the same two minutes together. And what we saw had no existence a month before, and probably will be changed in every essential feature a month from hence. The prominent object was fire in motion ; but the surface of the double lake was continually skimming over for a second or two with a cool crust of lustrous grey-white, like frost-silver, broken by jagged cracks of a bright rose-color. The movement was nearly always from the sides to the centre ; but the movement of the centre itself appeared independent, and always took a southerly direction. Before each outburst of agitation there was much hissing and throbbing, with internal roaring as of imprisoned gases. Now it seemed furious, demoniacal, as if no power on earth could bind it, then playful and sportive ; then for a second languid, but only because it was accumulating fresh force. Sometimes the whole lake took the form of mighty waves, and, surging heavily against the partial barrier with a sound like the Pacific surf, lashed, tore, covered it, and threw itself over it in clots of living fire. It was all confusion, commotion, forces, terror, glory, majesty, mystery, and even beauty. And the color, ‘ eye hath not seen ’ it ! Molten metal hath not that crimson gleam, nor blood that living light.”

To this description we may add that of Mr. Ellis, a former missionary to these islands, and one of the number who have

descended to the shores of Kilauea's abyss of fire. He says, after describing his difficult descent and progress over the lava-strewn pit :

MR. ELLIS VISITS THE LAKE OF LAVA

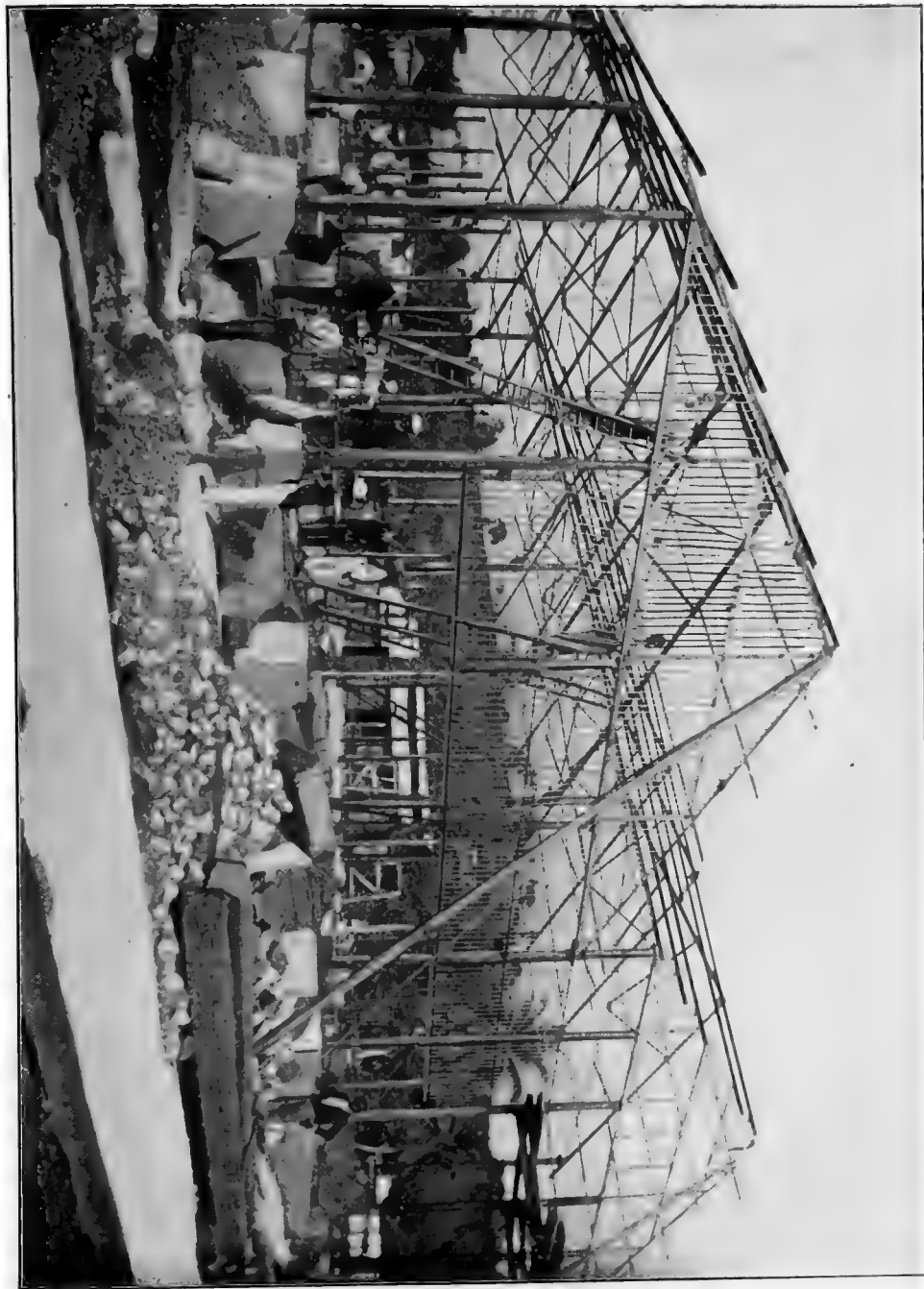
" Immediately before us yawned an immense gulf, in the form of a crescent, about two miles in length, from northeast to southwest ; nearly a mile in width, and apparently 800 feet deep. The bottom was covered with lava, and the southwestern and northern parts of it were one vast flood of burning matter in a state of terrific ebullition, rolling to and fro its 'fiery surges' and flaming billows. Fifty-one conical islands, of varied form and size, containing as many craters, rose either round the edge or from the surface of the burning lake ; twenty-two constantly emitted columns of gray smoke or pyramids of brilliant flame, and several of these at the same time vomited from their ignited mouths streams of lava, which rolled in blazing torrents down their black indented sides into the boiling mass below.

" The existence of these conical craters led us to conclude that the boiling cauldron of lava before us did not form the focus of the volcano ; that this mass of melted lava was comparatively shallow, and that the basin in which it was contained was separated by a stratum of solid matter from the great volcanic abyss, which constantly poured out its melted contents through these numerous craters into this upper reservoir. The sides of the gulf before us, although composed of different strata of ancient lava, were perpendicular for about 400 feet, and rose from a wide horizontal ledge of solid black lava of irregular breadth, but extending completely round. Beneath this ledge the sides sloped gradually towards the burning lake, which was, as nearly as we could judge, 300 or 400 feet lower.

"It was evident that the large crater had been recently filled with liquid lava up to this black ledge, and had, by some subterranean canal, emptied itself into the sea or spread under the low land on the shore. The gray and in some places apparently calcined sides of the great crater before us, the fissures which intersected the surface of the plain on which we were standing, the long banks of sulphur on the opposite side of the abyss, the vigorous action of the numerous small craters on its borders, the dense columns of vapor and smoke that rose at the north and west end of the plain, together with the ridge of steep rocks by which it was surrounded, rising probably in some places 300 or 400 feet in perpendicular height, presented an immense volcanic panorama, the effect of which was greatly augmented by the constant roaring of the vast furnaces below."

MAUNA LOA IN ERUPTION

Of the two great craters of Mauna Loa, the summit one has frequently in modern times overflowed its crest and poured its molten streams in glowing rivers over the land. This has rarely been the case with the lower and incessantly active crater of Kilauea, whose lava, when in excess, appears to escape by subterranean channels to the sea. We append descriptions of some of the more recent examples of Mauna Loa's eruptive energy. The lava from this crater does not alone flow over the crater's lip, but at times makes its way through fissures far below, the immense pressure causing it to spout in great flashing fountains high into the air. In 1852 the fiery fountains reached a height of 500 feet. In some later eruptions they have leaped 1,000 feet high. The lava is white hot as it ascends, but it assumes a blood-red tint in its fall, and strikes the ground with a frightful noise.





A PANORAMIC VIEW OF KINGSTOWN ISLAND OF ST. VINCENT

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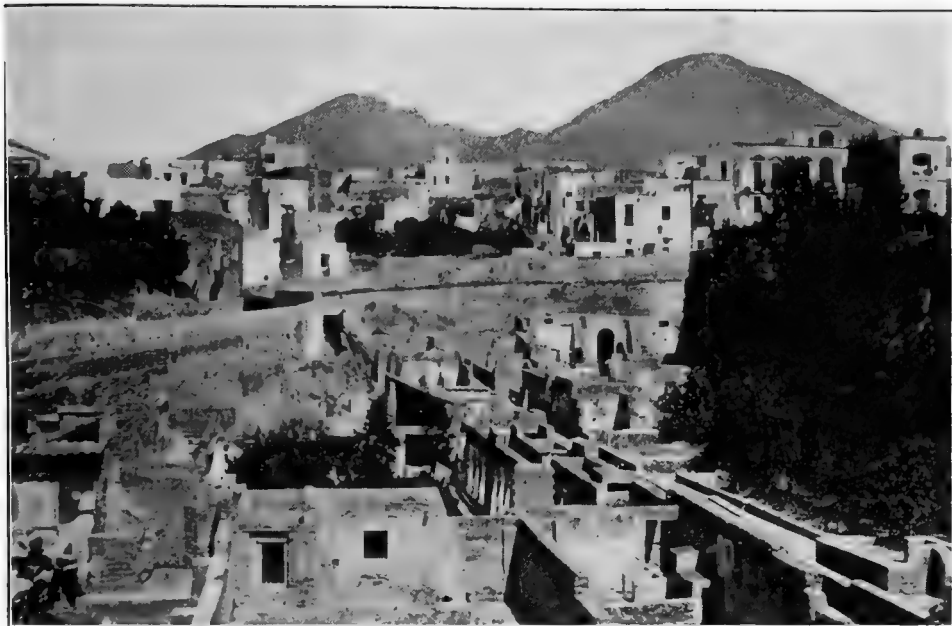


SHIPPING DOCKS AND BEACH IN MARTINIQUE



**ISLAND OF ST. LUCIA, NEAR MARTINIQUE, PARTLY OVERWHELMED WITH THE
ASHES FROM MT. PELEE**

Digitized by Microsoft



EXCAVATED RUINS OF POMPEII
Vesuvius in the Background



Digitized by Microsoft®
A STREET IN POMPEII.

Showing walls and pavement in the streets as found after excavations were made.



A STREET IN KINGSTOWN, ST. VINCENT





DEATH OF THE CAPTAIN OF THE RORAIMA

The quantities of lava ejected in some of the recent eruptions have been enormous. The river-like flow of 1855 was remarkable for its extent, being from two to eight miles wide, with a depth of from three to three hundred feet, and extending in a winding course for a distance of sixty miles. The Apostle of Hawaiian volcanoes, the Rev. Titus Coan, who ventured to the source of this flow while it was in supreme action, thus describes it :—

“ We ascended our rugged pathway amidst steam and smoke and heat which almost blinded and scathed us. We came to open orifices down which we looked into the fiery river which rushed madly under our feet. These fiery vents were frequent, some of them measuring ten, twenty, fifty or one hundred feet in diameter. In one place we saw the river of lava uncovered for thirty rods and rushing down a declivity of from ten to twenty-five degrees. The scene was awful, the momentum incredible, the fusion perfect (white heat), and the velocity forty miles an hour. The banks on each side of the stream were red-hot, jagged and overhanging. As we viewed it rushing out from under its ebon counterpane, and in the twinkling of an eye diving again into its fiery den, it seemed to say, ‘Stand off! Scan me not! I am God’s messenger. A work to do. Away!’ ”

Later he wrote again :—“ The great summit fountain is still playing with fearful energy, and the devouring stream rushes madly down toward us. It is now about ten miles distant, and heading directly for our bay. In a few days we may be called to announce the painful fact that our beauteous Hilo is no more,—that our lovely, our inimitable landscape, our emerald bowers, our crescent strand and our silver bay are blotted out. A fiery sword hangs over us. A flood of burning ruin approaches us. Devouring fires are near us. With sure and solemn progress the glowing

fusion advances through the dark forest and the dense jungle in our rear, cutting down ancient trees of enormous growth and sweeping away all vegetable life. For months the great summit furnace on Mauna Loa has been in awful blast. Floods of burning destruction have swept wildly and widely over the top and down the sides of the mountain. The wrathful stream has overcome every obstacle, winding its fiery way from its high source to the bases of the everlasting hills, spreading in a molten sea over the plains, penetrating the ancient forests, driving the bellowing herds, the wild goats and the affrighted birds before its lurid glare, leaving nothing but ebon blackness and smoldering ruin in its track."

His anticipation of the burial of Hilo under the mighty flow was happily not realized. It came to an abrupt halt while seven miles distant, the checked stream standing in a threatening and rugged ridge, with rigid, beetling front.

THE ERUPTIONS OF 1859 AND 1865

In January, 1859, Mauna Loa was again at its fire-play, throwing up lava fountains from 800 to 1,000 feet in height. From this great fiery fountain the lava flowed down in numerous streams, spreading over a width of five or six miles. One stream, probably formed by the junction of several smaller, attained a height of from twenty to twenty-five feet, and a breadth of about an eighth of a mile. Great stones were thrown up along with the jet of lava, and the volume of seeming smoke, composed probably of fine volcanic dust, is said to have risen to the height of 10,000 feet.

An eruption of still greater violence took place in 1865, characterized by similar phenomena, particularly the throwing up of jets of lava. This fiery fountain continued to play without intermission

for twenty days and nights, varying only as respects the height to which the jet arose, which is said to have ranged between 100 and 1,000 feet, the mean diameter of the jet being about 100 feet. This eruption was accompanied by explosions so loud as to have been heard at a distance of forty miles.

A cone of about 300 feet in height, and about a mile in circumference, was accumulated round the orifice whence the jet ascended. It was composed of solid matters ejected with the lava, and it continued to glow like a furnace, notwithstanding its exposure to the air. The current of lava on this occasion flowed to a distance of thirty-five miles, burning its way through the forests, and filling the air with smoke and flames from the ignited timber. The glare from the glowing lava and the burning trees together was discernible by night at a distance of 200 miles from the island.

THE LAVA FLOW OF 1880

A succeeding great lava flow was that which began on November 6, 1880. Mr. David Hitchcock, who was camping on Mauna Kea at the time of this outbreak, saw a spectacle that few human eyes have ever beheld. "We stood," writes he, "on the very edge of that flowing river of rock. Oh, what a sight it was! Not twenty feet from us was this immense bed of rock slowly moving forward with irresistible force, bearing on its surface huge rocks and immense boulders of tons' weight as water would carry a toy-boat. The whole front edge was one bright red mass of solid rock incessantly breaking off from the towering mass and rolling down to the foot of it, to be again covered by another avalanche of white-hot rocks and sand. The whole mass at its front edge was from twelve to thirty feet in height. Along the entire line of its advance it was one crash of rolling, sliding, tumbling red-hot rock. We could hear

no explosions while we were near the flow, only a tremendous roaring like ten thousand blast furnaces all at work at once."

This was the most extensive flow of recent years, and its progress from the interior plain through the dense forests above Hilo and out on to the open levels close to the town was startling and menacing enough. Through the woods especially it was a turbulent, seething mass that hurled down mammoth trees, and licked up streams of water, and day and night kept up an unintermitting cannonade of explosions. The steam and imprisoned gases would burst the congealing surface with loud detonations that could be heard for many miles. It was not an infrequent thing for parties to camp out close to the flow over night. Ordinarily a lava-flow moves sluggishly and congeals rapidly, so that what seems like hardihood in the narrating is in reality calm judgment, for it is perfectly safe to be in the close vicinity of a lava-stream, and even to walk on its surface as soon as one would be inclined to walk on cooling iron in a foundry. This notable flow finally ceased within half a mile of Hilo, where its black form is a perpetual reminder of a marvellous deliverance from destruction.

KILAUEA IN 1840

Kilauea seems never, in historic times, to have filled and overflowed its vast crater. To do so would need an almost inconceivable volume of liquid rock material. But it approached this culmination in 1840, when it became, through its whole extent, a raging sea of fire. The boiling lava rose in the mighty mountain-cup to a height of from 500 to 600 feet. Then it forced a passage through a subterranean cavity twenty-seven miles long, and reached the sea, forty miles distant, in two days. The stream where it fell into the sea was half a mile wide, and the flow kept up for three weeks, heating

the ocean twenty miles from land. An eye-witness of this extraordinary flow thus describes it :

“ When the torrent of fire precipitated itself into the ocean, the scene assumed a character of terrific and indescribable grandeur. The magnificence of destruction was never more perceptibly displayed than when these antagonistic elements met in deadly strife. The mightiest of earth’s magazines of fire poured forth its burning billows to meet the mightiest of oceans. For two score miles it came rolling, tumbling, swelling forward, an awful agent of death. Rocks melted like wax in its path ; forests crackled and blazed before its fervent heat ; the works of man were to it but as a scroll in the flames. Imagine Niagara’s stream, above the brink of the Falls, with its dashing, whirling, madly-raging waters hurrying on to their plunge, instantaneously converted into fire ; a gory-hued river of fused minerals ; volumes of hissing steam arising ; some curling upward from ten thousand vents, which give utterance to as many deep-toned mutterings, and sullen, confined clamorings ; gases detonating and shrieking as they burst from their hot prison-house ; the heavens lurid with flame ; the atmosphere dark and oppressive ; the horizon murky with vapors and gleaming with the reflected contest !

“ Such was the scene as the fiery cataract, leaping a precipice of fifty feet, poured its flood upon the ocean. The old line of coast, a mass of compact, indurated lava, whitened, cracked and fell. The waters recoiled, and sent forth a tempest of spray ; they foamed and dashed around and over the melted rock, they boiled with the heat, and the roar of the conflicting agencies grew fiercer and louder. The reports of the exploding gases were distinctly heard twenty-five miles distant, and were likened to a whole broad-side of heavy artillery. Streaks of the intensest light glanced like

lightning in all directions; the outskirts of the burning lava as it fell, cooled by the shock, were shivered into millions of fragments, and scattered by the strong wind in sparkling showers far into the country. For three successive weeks the volcano disgorged an uninterrupted burning tide, with scarcely any diminution, into the ocean. On either side, for twenty miles, the sea became heated, with such rapidity that, on the second day of the junction of the lava with the ocean, fishes came ashore dead in great numbers, at a point fifteen miles distant. Six weeks later, at the base of the hills, the water continued scalding hot, and sent forth steam at every wash of the waves."

THE SINKING OF KILAUEA'S FIRE-LAKE

In 1866 the great crater of Kilauea presented a new and unlooked-for spectacle in the sinking and vanishing of its great lava lake. In March of that year the fires in the ancient cauldron totally disappeared, and the surrounding lava rock sank to a depth of nearly 600 feet. Mr. Thrum, in a pamphlet on "The Suspended Activity of Kilauea," says of it:

"Distant rumbling noises were heard, accompanied by a series of earthquakes, forty-three in number. With the fourth shock the brilliancy of New Lake disappeared, and towards 3 A. M. the fires in Halemaumau disappeared also, leaving the whole crater in darkness.

"With the dawn the shocks and noises ceased, and revealed the changes which Kilauea had undergone in the night. All the high cliffs surrounding Halemaumau and New Lake, which had become a prominent feature in the crater, had vanished entirely, and the molten lava of both lakes had disappeared by some subterranean passage from the bottom of Halemaumau. There was no material

change in the sunken portion of the crater except a continual falling in of rocks and debris from its banks as the contraction from its former intense heat loosened their compactness and sent them hurling some 200 or 300 feet below, giving forth at times a boom as of distant thunder, followed by clouds of cinders and ashes shooting up into the air 100 to 300 feet, proportionate, doubtless, to the size of the newly fallen mass."

This remarkable recession of the liquid lava in Halemaumau was probably due to the opening of some deep subterranean passage through which the lake of lava made its way unseen to the ocean's depths. The Rev. Mr. Baker, probably the most adventuresome explorer of Hawaiian volcanoes, actually descended into that crumbling pit to a point within what he judged to be fifty feet of the bottom. But Halemaumau had only taken an intermission, for in two short months signs of returning life became frequent and unmistakable, and, in June, culminated in the sudden outbreak of a lake that has since then steadily increased in activity.

THE GODDESS PELE

We cannot close this chapter without some reference to the Goddess Pele, to whom the Hawaiians long imputed the wonder-work of their volcanic mountains. When there is unusual commotion in Kilauea myriads of thread-like filaments float in the air and fall upon the cliffs, making deposits much resembling matted hair. A single filament over fifteen inches long was picked up on a Hilo veranda, having sailed in the air a distance of fifty miles. This is the famous Pele's Hair, being the glass-like product of volcanic fires. It resembles Prince Rupert's Drops, and the tradition is that whenever the volcano becomes active it is because Pele, the Goddess of the crater, emerges from her fiery furnace and shakes her vitreous locks in anger.

This fabled being, according to Emerson, in a paper on "The Lesser Hawaiian Gods," "could at times assume the appearance of a handsome young woman, as when Kamapuaa, to his cost, was smitten with her charms when first he saw her with her sisters at Kilauea." Kamapuaa was a gigantic hog, who "could appear as a handsome young man, a hog, a fish or a tree." "At other times the innate character of the fury showed itself, and Pele appeared in her usual form as an ugly and hateful old hag, with tattered and fire-burnt garments, scarcely concealing the filth and nakedness of her person. Her bloodshot eyes and fiendish countenance paralyzed the beholder, and her touch turned him to stone. She was a jealous and vindictive monster, delighting in cruelty, and at the slightest provocation overwhelming the unoffending victims of her rage in widespread ruin."

The superstition regarding the Goddess Pele was thought to have received a death blow in 1825, when Kapiolani, an Hawaiian princess and a Christian convert, ascended, with numerous attendants, to the crater of Kilauea, where she publicly defied the power and wrath of the goddess. No response came to her defiance, she descended in safety, and faith in Pele's power was widely shaken.

Yet as late as 1887 the old superstition revived and claimed an exalted victim, for in that year the Princess Like Like, the youngest sister of the king, starved herself to death to appease the anger of the Goddess Pele, supposed to be manifested in Mauna Loa's eruption of that year, and to be quieted only by the sacrifice of a victim of royal blood. Thus slowly do the old superstitions die away.

CHAPTER XXI.

Volcanoes of South America and the West African Islands.

SOUTH AMERICA is famous for the great number and vast size of its volcanoes, mainly found in the mighty range of the Andes. Among these the most remarkable are Cotopaxi, Tunguragua, Pichincha, Antisana, and Sangay. Of these Cotopaxi is not only the loftiest volcano in South America, but in the world, its elevation, according to Whymper, being 19,550 feet. It presents a cone of remarkable regularity, its summit, which is uniformly covered with perpetual snow, looking almost as if turned in a lathe. Below the sharply-defined snow-line woodland extends to its base. Though eruptions are rare, a column of vapor continually ascends from its lofty peak.

If we can accept the traditions of the natives, this mountain could not always claim its proud pre-eminence in height, since they state that the mountain called Capac-Urcu was once still higher than Cotopaxi, or even than Chimborazo, with its 20,100 feet. They tell us that, not long before the discovery of America by the Spaniards, there took place a series of dreadful eruptions, which lasted eight years, during which the cone of Capac-Urcu was broken down, and that its fragments now lie scattered over the adjacent plains. Similar occurrences elsewhere render this tradition by no means improbable.

Most picturesque among the volcanoes of the Andes is Pichincha, which is 15,800 feet high and consists of several cones, of which four are conspicuous—the most southerly, named Raus, being that which contains the active crater. It is on a plain formed on the flanks of this mountain that Quito is situated ; and to this dangerous neighborhood that beautiful city doubtless owed its overthrow in 1849 by a destructive earthquake. Baron Humboldt ascended to the crater of Pichincha, and nearly lost his life in the adventure. Having approached the edge, in order to obtain a view of the lava boiling at the bottom of the abyss, he became enveloped in a dense fog, and nearly stepped upon the steep incline, which descends so rapidly that, had he once planted his foot on it, he would have slid into the glowing lake of fire beneath.

Small volcanoes are usually the most active, and the great height of those in the Andes has probably much to do with the infrequency of their eruptions, though this rule does not always hold good.

ERUPTIONS OF MUD

The eruptions from the South American volcanoes are quite as frequently of sulphurous mud as of lava. An eruption from Imbaburu in 1691, of which we have previously spoken, was of this character, the mud bringing with it so great a quantity of small fish as to cause a fever from their pestilential effluvia. In June, 1698, a similar event took place at Carguairazo, whose cone fell in, and a great eruption of mud succeeded, in which also were dead fish.

This peculiar fact was repeated in 1799 during an eruption of Tunguragua, which accompanied the terrible earthquake by which the city of Riobamba was destroyed. During the earthquake shocks the crater gave off less vapor than usual, but enormous fissures opened at its base, whence issued immense volumes of

water and fetid mud, which overflowed the country around to a wide extent. In some of the neighboring valleys, 1,000 feet wide, the water rose to a height of 600 feet. In the hollows the mud accumulated in such masses as to check the flow of the rivers, which rose so as to form large lakes, these remaining for more than eighty days. The floods contained immense quantities of fish of a peculiar species, suggesting that the water may have come from subterranean lakes in the vicinity of the volcano. The mud was probably composed of sulphurous dust and ashes from the volcano.

The materials emitted from these volcanoes, however, is by no means confined to mud, Antisana, for instance, being notable for the large streams of lava which it has poured forth. This mountain had frequent fits of activity between 1590 and 1718, since which time it has been quiet. At the height of about 13,600 feet above the sea-level is a plain, formerly the bed of a considerable lake, now reduced to very narrow limits. From the centre of this plain rises the snow-clad summit, containing a dome-like portion, connected by a group of jagged peaks with a truncated cone of eruption situated on the north side. The ejected lavas have formed numerous walls of basalt at the foot of the mountain, and there are also great beds of very spongy pumice.

SANGAY IN INCESSANT ACTIVITY

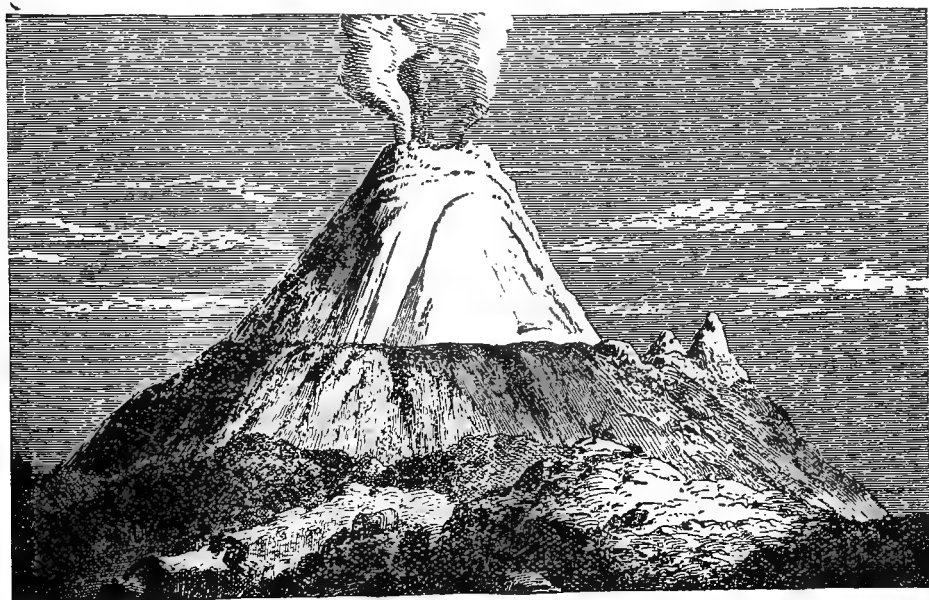
Sangay is an exception to the rule of small volcanoes being the most active. Although towering to the height of upward of 18,000 feet, its activity has ever since 1728 been almost incessant. Its eruptions are accompanied by loud detonations, which are heard at great distances. In 1842 and 1845 its thunderings were heard at Payta, on the Peruvian coast. These explosions sometimes succeed each other with amazing rapidity; but so loose and incoherent

are the materials composing the cone that no concussion is felt. The fumes from the crater are very dense—sometimes gray, sometimes orange, in color. The solid substances thrown out along with these fumes are cinders and dross, occasionally accompanied by round stones of about two feet in diameter. These either fall back again into the crater, or alight on the edge of the cone, to which they impart an incandescent glow. On cooling, the ejected matters become quite black, so that they give the general surface of the cone a most dismal aspect. They are accumulated on the slope and all around the base of the cone in beds, some parts of which attain a thickness of between 300 and 400 feet.

THE VOLCANOES OF CHILI

Another exception to the general infrequency of paroxysms of activity among the South American volcanoes, is presented by Rancagua, in Chili, which is in a state of perpetual restlessness similar to that of Stromboli. Chillan, another of the volcanoes of Chili, burst into action in November 1864, when there was formed a new crater, whence immense quantities of ashes and other loose matters were ejected, along with streams of lava. The whole summit of the cone, which is usually snow-clad, became covered with volcanic ashes in a layer of considerable depth. This fact illustrates the manner in which layers of ice and snow may alternate with layers of lava; for such thick coatings of ashes will prevent the lava from melting the snow to any considerable extent, and will rather facilitate its conversion into ice. The snow being first reduced to a half-melted state, and then subjected to the pressure of the lava, regelation ensues, and very hard and compact ice is formed beneath.

Coming now to the greatest of South American volcanoes, the lofty Cotopaxi, situated about 35 miles from Quito, we find it credited with numerous eruptions, some of them very destructive. The earliest on record were those of 1532 and 1533. In the latter year the mountain, which has the reputation of flinging large stones to great distances, is said to have hurled one huge mass, of 200 tons weight, to a distance of about ten miles. The eruption



COTAPAXI,
The Loftiest Volcano on the Earth

of 1744 continued for three years, immense streams of lava spreading over the adjacent plains. The thundering roar of this great outbreak was heard at Hondo, on the Rio Magdalena, about 500 miles away. Other great eruptions were in 1768 and 1803. In the latter instance Humboldt, then 160 miles distant, heard the fierce explosions night and day like the continued discharges from a battery. Eruptions of some importance were those of 1850, 1854, 1856 and 1864. A later one, in 1877, is thus described:

“First a great column of dust was ejected, followed next day by a second mass, which drifted high in the air above Quito, so that midday was dark as night. The next day the summit of the volcano was clear, but about ten o'clock some people who were looking at it ‘saw molten lava pouring through the gapes and notches in the lip of the crater, bubbling and smoking, so they described it, like the froth of a pot that suddenly boils over.’ After this what ensued upon the mountain no man could see, for in a few minutes the whole of it was enveloped in smoke and steam, and became invisible, ‘but out of the darkness a moaning noise arose, which grew into a roar, and a deluge of water—due to the melting snow—with blocks of ice, mud and rock, rushed down, sweeping away everything that lay in its course, and leaving a desert in its rear.’ The molten matter, as Mr. Whympers points out, which overflowed from the crater, and fell in streams or cascades upon the surrounding slopes of snow and ice, must often have been sent flying into the air in shattered fragments and splashes by the sudden development of steam, and ‘portions of the glaciers, uncemented from their attachments by the enormous augmentation of heat, slipped away bodily, and, partly rolling, partly borne by the growing floods, arrived at the bottom a mass of shattered blocks.’ The villages to a distance of seventy miles around were buried under a deposit of mud and other materials.”

MR. WHYMPER'S ACCOUNT OF HIS ASCENT

Humboldt, in 1802, and several later travelers attempted to ascend Cotapaxi's icy cone, but in vain, and it was not until 1872 that Dr. Wilhelm Reiss succeeded in reaching the top. Others have since accomplished this feat, among them Mr. Whympers, who passed a night on the cone just below its summit and looked

into the crater. He gives the following account of what he saw :

“An amphitheater 2,300 feet in diameter from north to south, and 1,650 feet across from east to west, with a rugged and irregular crest, notched and cracked, surrounded by cliffs, by perpendicular and even overhanging precipices, mixed with steep slopes ; some bearing snow, and others apparently incrustated with sulphur. Cavernous recesses belched forth smoke ; the sides of cracks and chasms, no more than halfway down, shone with ruddy light ; and so it continued on all sides right down to the bottom, precipice alternating with slope, and the fiery fissures becoming more numerous as the bottom was approached.

“At the bottom, probably 1,200 feet below us, and towards the centre, there was a rudely circular spot, about one-tenth the diameter of the crater, the pipe of the volcano, its channel of communication with the lower regions, filled with incandescent, if not molten, lava, glowing and burning ; with flames traveling to and fro over its surface, and scintillations scattering as from a wood fire ; lighted by tongues of flickering flame, which issued from the cracks in the surrounding slopes. At intervals of about half an hour the volcano regularly blew off steam. It arose in jets with great violence from the bottom of the crater, and boiled over the lip, continually enveloping us. The noise on these occasions resembled that which we hear when a large ocean steamer is blowing off steam.”

ANOTHER EPISODE OF THE MOUNTAIN'S ACTIVITY

Another episode in Mr. Whymper's experience illustrates a milder phase of the mountain's activity. It occurred when he was making his second ascent of Chimborazo. The sky was bright, and the cone of Cotopaxi, sixty miles away, stood up clear in the dawning light. The great volcano was unusually tranquil ; not a sign

of smoke rose from its crater. "At 5.40 A. M. two puffs of steam were emitted, and then there was a pause. At 5.45 a column of inky blackness began to issue, and went straight into the air with such prodigious velocity that in less than a minute it had risen 20,000 feet above the rim of the crater." At this height it appeared to be caught by a powerful current of air from the east, and was "rapidly borne toward the Pacific; remaining intensely black, seeming to spread very slightly"; then it was caught by another current from the north, and drifted toward Chimborazo, spreading out rapidly. When the party reached the summit, though the cloud was then hovering overhead, the snows were clean; but about ten minutes afterward the dust began to fall, and, in the course of an hour, gave the white dome the aspect of a plowed field. In Mr. Whymper's words: "It filled our eyes and nostrils, rendered eating and drinking impossible, and at last reduced us to breathing through handkerchiefs. The dust had occupied some seven and a half hours on its aerial journey."

THE FAMOUS PEAK OF TENERIFFE

Passing from the line of the Andes to that of the volcanic islands adjoining the west coast of Africa, we find ourselves in a region of some degree of volcanic activity, though not equalling that of the mountains just considered, this being, as has been previously said, a region of declining volcanism. The most active vents are those of the Canary Islands, the Azores, though they have been much troubled with earthquakes, having at present but one active crater, that of El Pico, which constantly sends off vapors.

The volcanoes of the Canary Islands are of greater interest; for among them is the famous Peak of Teneriffe, whose snow-clad

summit is a conspicuous land-mark to the mariner. The total height of the mountain is 12,090 feet; but that of the cone is only about 550 feet. Nothing has been emitted from the crater on the summit since it was known to Europeans, but columns of vapor. There were, however, lateral eruptions in 1704 and 1706, resulting in the destruction of the best harbor in the island. This mountain contains a subsidiary elevation, named Chahorra, and there was an eruption from a crater formed upon it in 1798, which continued for more than three months. Streams of lava and quantities of ashes and stones were thrown out on this occasion; and it is affirmed by Humboldt that some of the stones were projected to a height so great that they occupied from twelve to fifteen seconds in their descent—thus showing that some of them must have been tossed to a height of about 3,000 feet. This eminent traveler visited the principal crater on the summit of the Peak, and found it to be of an oval form and small dimensions—300 feet in its longer and 200 feet in its shorter diameter, with a depth of about 100 feet.

The neighboring island of Palma contains a vast volcanic crater, called the Great Caldera, which is no less than 5,000 feet in depth. In the mountain forming the walls of this crater are numerous deep ravines called *baraccos*, which are regarded as fissures that have been rent by volcanic action.

VOLCANOES IN THE ISLAND OF LANCEROTA

The volcanoes in the island of Lancerota are those which have been most recently in action, a crater having opened in August, 1824, near the port of Rescif in this island. The eruption was preceded by violent earthquakes, and the quantity of matter ejected was so great as to form a considerable hill in twenty-four hours. The phenomena appear to have resembled those attending the formation of Monte Nuovo near Naples.

But Lancerota was, during the last century, the scene of a far grander series of eruptions, which lasted for no less than six years. They began on the 1st of September, 1730, when there was thrown up a quantity of volcanic materials so immense as to form in one night a considerable hill. A few days later there was opened another crater, whence flowed a stream of lava which overwhelmed several villages. On the 7th of September there was thrust up with a thundering noise, from the bottom of a lava-stream, a huge solid rock, which, dividing the current, so changed its direction as to cause it to overflow, in its new course, the large and flourishing town of St. Catalina, besides several villages. Four days after this, the lava, receiving a great accession, advanced into the sea with a terrific roar. Vast quantities of fish were killed, and thrown up to the surface or stranded on the beach. After a short rest there were opened on the very site of St. Catalina, which had been overflowed by the lava, three new craters, whence were vomited large quantities of sand, stones, and ashes.

On the 28th of October a remarkable occurrence took place—all the cattle in the island dropped down dead. They had been choked by noxious vapors which rose from the ground, and, being condensed on ascending into the air, fell in showers. To add to the terror of the inhabitants inspired by the fiery streams, there rose a furious tempest, exceeding in violence any that had ever been experienced in the island before. On the 10th of January, 1731, there was thrown up a hill of considerable height ; which on the same day fell down again into the crater whence it rose, giving place to several currents of lava, which made their way to the sea. In the following months of January and March, there were raised several new cones, which poured forth lava ; and fresh additions were subsequently made to their number, till it amounted to about

thirty. In the following June the western shores were covered with dying fish of different species—some of them quite new to the inhabitants. Smoke and flames were seen to rise from the sea, at a short distance from the coast. This condition of volcanic activity in the island did not cease till 1736, and the eruptions compelled a large portion of the inhabitants to emigrate to the neighboring islands.

To the southward of the Canaries lie the Cape de Verde Islands, which are also volcanic. In one of them is a volcano named Fuego, which, after a repose of fifty years, burst out afresh in 1847. There were opened no less than seven mouths, whence issued great streams of lava, that desolated the highly cultivated parts of the island, destroying many cattle and inflicting grievous loss on the inhabitants.

CHAPTER XXII.

Popocatāpetl and Other Volcanoes of Mexico and Central America.

MEXICO is very largely a vast table-land, rising through much of its extent to an elevation of from 7,000 to 8,000 feet above sea-level, and bounded east and west by wide strips of torrid lowlands adjoining the oceans. It is crossed at about 19° north latitude by a range of volcanic mountains, running in almost a straight line east and west, upon which are several extinct volcanic cones, and five active or quiescent volcanoes. The highest of these is Popocatapetl, south of the city of Mexico and nearly midway between the Atlantic and Pacific.

East of this mountain lies Orizabo, little below it in height, and San Martin or Tuxtla, 9,700 feet high, on the coast south of Vera Cruz. West of it is Jorullo, 4,000 feet, and Colima, 12,800, near the Pacific coast. The volcanic energy continues southward toward the Isthmus, but decreases north of this volcanic range. These mountains have shown little signs of activity in recent times. Popocatapetl emits smoke, but there is no record of an eruption since 1540. Orizabo has been quiet since 1566. Tuxtla had a violent eruption in 1793, but since then has remained quiescent. Colima is the only one now active. For ten years past it has been emitting ashes and smoke. The most remarkable of these volcanoes is Jorullo, which closely resembled Monte Nuovo, described in Chapter XIII., in its mode of origin.

Popocatepetl, the hill that smokes, in the Mexican language, the huge mountain clothed in eternal snows, and regarded by the idolators of old as a god, towers up nearly 18,000 feet above the level of the sea, and in the days of the conquest of Mexico was a volcano in a state of fierce activity. It was looked upon by the natives with a strange dread, and they told the white strangers with awe that no man could attempt to ascend its slopes and yet live; but, from a feeling of vanity, or the love of adventure, the Spaniards laughed at these fears, and accordingly a party of ten of the followers of Cortes commenced the ascent, accompanied by a few Indians. But these latter, after ascending about 13,000 feet to where the last remains of stunted vegetation existed, became alarmed at the subterranean bellowings of the volcano, and returned, while the Spaniards still painfully toiled on through the rarefied atmosphere, their feet crushing over the scorix and black-glazed volcanic sand, until they stood in the region of perpetual snow, amidst the glittering, treacherous glaciers and crevasses, with vast slippery-pathed precipices yawning round.

Still they toiled on in this wild and wondrous region. A few hours before they were in a land of perpetual summer; here all was snow. They suffered the usual distress awarded to those who dare to ascend to these solitudes of nature but it was not given to them to achieve the summit, for suddenly, at a higher elevation, after listening to various ominous threatenings from the interior of the volcano, they encountered so fierce a storm of smoke, cinders, and sparks, that they were driven back half suffocated to the lower portions of the mountain.

Some time after another attempt was made; and upon this occasion with a definite object. The invaders had nearly exhausted their stock of gunpowder, and Cortes organized a party to ascend

to the crater of the volcano, to seek and bring down sulphur for the manufacture of this necessary of warfare. This time the party numbered but five, led by one Francisco Montano ; and they experienced no very great difficulty in winning their way upwards. The region of verdure gave place to the wild, lava-strewn slope, which was succeeded in its turn by the treacherous glaciers ; and at last the gallant little band stood at the very edge of the crater, a vast depression of over a league in circumference, and 1,000 feet in depth.

SULPHUR FROM THE CRATER

Flame was issuing from the hideous abysses, and the stoutest man's heart must have quailed as he peered down into the dim, mysterious cavity to where the sloping sides were crusted with bright yellow sulphur, and listened to the mutterings which warned him of the pent-up wrath and power of the mighty volcano. They knew that at any moment flame and stifling sulphurous vapor might be belched forth, but now no cowardice was shown. They had come provided with ropes and baskets, and it only remained to see who should descend. Lots were therefore drawn, and it fell to Montano, who was accordingly lowered by his followers in a basket 400 feet into the treacherous region of eternal fires.

The basket swayed and the rope quivered and vibrated, but the brave cavalier sturdily held to his task, disdaining to show fear before his humble companions. The lurid light from beneath flashed upon his tanned features, and a sulphurous steam rose slowly and condensed upon the sides ; but, whatever were his thoughts, the Spaniard collected as much sulphur as he could take up with him, breaking off the bright incrustations, and even dallying with his task as if in contempt of the danger, till he had leisurely filled his basket, when the signal was given and he was drawn up.

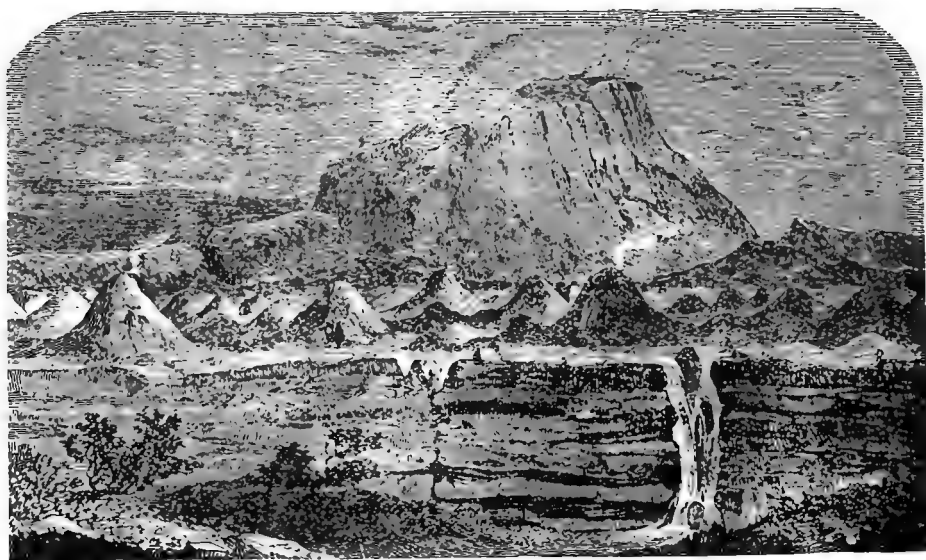
The basket was emptied, and then he once more descended into the lurid crater, collected another store and was again drawn up ; but far from shrinking from his task, he descended again several times, till a sufficiency had been obtained, with which the party descended to the plain.

THE VOLCANO JORULLO

No further back than the middle of the eighteenth century the site of Jorullo was a level plain, including several highly-cultivated fields, which formed the farm of Don Pedro di Jorullo. The plain was watered by two small rivers, called Cuitimba and San Pedro, and was bounded by mountains composed of basalt—the only indications of former volcanic action. These fields were well irrigated, and among the most fertile in the country, producing abundant crops of sugar-cane and indigo.

In the month of June, 1759, the cultivators of the farm began to be disturbed by strange subterranean noises of an alarming kind, accompanied by frequent shocks of earthquake, which continued for nearly a couple of months ; but they afterward entirely ceased, so that the inhabitants of the place were lulled into security. On the night between the 28th and 29th of September, however, the subterranean noises were renewed with greater loudness than before, and the ground shook severely. The Indian servants living on the place started from their beds in terror, and fled to the neighboring mountains. Thence gazing upon their master's farm they beheld it, along with a tract of ground measuring between three and four square miles, in the midst of which it stood, rise up bodily, as if it had been inflated from beneath like a bladder. At the edges this tract was uplifted only about 39 feet above the original surface, but so great was its convexity that toward the middle it attained a height of no less than 524 feet.

The Indians who beheld this strange phenomenon declared that they saw flames issuing from several parts of this elevated tract, that the entire surface became agitated like a stormy sea, that great clouds of ashes, illuminated by volcanic fires glowing beneath them, rose at several points, and that white-hot stones were thrown to an immense height. Vast chasms were at the same time opened in the ground, and into these the two small rivers above



JORULLO, THE GREAT MEXICAN VOLCANO

mentioned plunged. Their waters, instead of extinguishing the subterranean conflagration, seemed only to add to its intensity. Quantities of mud, enveloping balls of basalt, were then thrown up, and the surface of the elevated ground became studded with small cones, from which volumes of dense vapor, chiefly steam, were emitted, some of the jets rising from 20 to 30 feet in height.

These cones the Indians called ovens, and in many of them was long heard a subterranean noise resembling that of water

briskly boiling. Out of a great chasm in the midst of those ovens there were thrown up six larger elevations, the highest being 1,640 feet above the level of the plain, 4,315 above sea level, and now constituting the principal volcano of Jorullo. The smallest of the six was 300 feet in height; the others of intermediate elevation. The highest of these hills had on its summit a regular volcanic crater, whence there have been thrown up great quantities of dross and lava, containing fragments of older rocks. The ashes were transported to immense distances, some of them having fallen on the houses at Queretaro, more than forty-eight leagues from Jorullo. The volcano continued in this energetic state of activity for about four months; in the following years its eruptions became less frequent, but it still continues to emit volumes of vapor from the principal crater, as well as from many of the ovens in the upheaved ground.

EFFECT ON THE RIVERS

The two rivers, which disappeared on the first night of this great eruption, now pursue an underground course for about a mile and a quarter, and then reappear as hot springs, with a temperature of 126° F.

This wonderful volcanic upheaval is all the more remarkable, from the inland situation of the plain on which it occurred, it being no less than 120 miles distant from the nearest ocean, while there is no other volcano nearer to it than 80 miles. The activity of the ovens has now ceased, and portions of the upheaved plain on which they are situated have again been brought under cultivation, and the volcano is in a state of quiescence.

The crater of Popocatepetl, which towers to a height of 17,000 feet, is a vast circular basin, whose nearly vertical walls are in some parts of a pale rose tint, in others quite black. The

bottom contains several small fuming cones, whence arise vapors of changeable color, being successively red, yellow and white. All round them are large deposits of sulphur, which are worked for mercantile purposes.

Orizaba has a little less lofty snow-clad peak. This mountain was in brisk volcanic activity from 1545 to 1560, but has since then relapsed into a prolonged repose. It was climbed, in 1856, by Baron Müller, to whose mind the crater appeared like the entrance to a lower world of horrible darkness. He was struck with astonishment on contemplating the tremendous forces required to elevate and rend such enormous masses—to melt them, and then pile them up like towers, until by cooling they became consolidated into their present forms. The internal walls of the crater are in many places coated with sulphur, and at the bottom are several small volcanic craters. At the time of his visit the summit was wholly covered with snow, but the Indians affirmed that hot vapors occasionally ascend from fissures in the rocks. Since then others have reached its summit, among them Angelo Heilprin, the first to gaze into the crater of Mont Pelee after its eruption.

ERUPTIONS IN NICARAGUA

On the 14th of November, 1867, there commenced an eruption from a mountain about eight leagues to the eastward of the city of Leon, in Nicaragua. This mountain does not appear to have been previously recognized as an active volcano, but it is situated in a very volcanic country. The outburst had probably some connection with the earthquake at St. Thomas, which took place on the 18th of November following. The mountain continued in a state of activity for about sixteen days. There was thrown out an immense quantity of black sand, which was carried as far as to the coast of

the Pacific, fifty miles distant. Glowing stones were projected from the crater to an estimated height of three thousand feet.

Central America is more prolific of volcanoes than Mexico, and the State of Guatemala in particular. One authority credits this State with fifteen or sixteen and another with more than thirty volcanic cones. Of these at least five are decidedly active. Tajumalco, which was in eruption at the time of the great earthquake of 1863, yields great quantities of sulphur, as also does Quesaltenango. The most famous is the Volcan de Agua (Water Volcano), so called from its overwhelming the old city of Guatemala with a torrent of water in 1541.

Nicaragua is also rich in volcanoes, being traversed its entire length by a remarkable chain of isolated volcanic cones, several of which are to some extent active. We have already told the story of the tremendous eruption of Coseguina in 1835, one of the most violent of modern times. The latest important eruption here was that of Ometepe, a volcanic mount on an island of the same name in Lake Nicaragua. This broke a long period of repose on June 19, 1883, with a severe eruption, in which the lava, pouring from a new crater, in seven days overflowed the whole island and drove off its population. Incessant rumblings and earthquake shocks accompanied the eruption, and mud, ashes, stones and lava covered the mountain slopes, which had been cultivated for many centuries. These were the most recent strong displays of volcanic energy in Central America, though former great outflows of lava are indicated by great fields of barren rock, which extend for miles.

CHAPTER XXIII.

The Terrible Eruption of Krakatoa.

THE most destructive volcanic explosion of recent times, one perhaps unequalled in violence in all times, was that of the small mountain island of Krakatoa, in the East Indian Archipelago, in 1883. This made its effects felt round the entire globe, and excited such wide attention that we feel called upon to give it a chapter of its own.

The island of Krakatoa lies in the Straits of Sunda, between Java and Sumatra. In size it is insignificant, and had been silent so long that its volcanic character was almost lost sight of. Of its early history we know nothing. At some remote time in the past it may have appeared as a large cone, of some twenty-five miles in circumference at base and not less than 10,000 feet high. Then, still in unknown times, its cone was blown away by internal forces, leaving only a shattered and irregular crater ring. This crater was two or three miles in diameter, while the highest part of its walls rose only a few hundred feet above the sea. Later volcanic work built up a number of small cones within the crater, and still later a new cone, called Rakata, rose on the edge of the old one to a height of 2,623 feet.

The first known event in the history of the island volcano was an eruption in the year 1680. After that it lay in repose, forming a group of islands, one much larger than the others. Some of the smaller islands indicated the rim of the old crater, much of which

was buried under the sea. Its state of quiescence continued for two centuries, a tropical vegetation richly mantled the island, and to all appearance it had sunk permanently to rest.

Indications of a coming change appeared in 1880, in the form of earthquakes, which shook all the region around. These continued at intervals for more than two years. Then, on May 20, 1883, there were heard at Batavia, a hundred miles away, "booming sounds like the firing of artillery." Next day the captain of a vessel passing through the Straits saw that Krakatoa was in eruption, sending up clouds of smoke and showers of dust and pumice. The smoke was estimated to reach a height of seven miles, while the volcanic dust drifted to localities 300 miles away.

AWFUL PREMONITIONS

The mountain continued to play for about fourteen weeks with varying activity, several parties meanwhile visiting it and making observations. Such an eruption, in ordinary cases, would have ultimately died away, with no marked change other than perhaps the ejection of a stream of lava. But such was not now the case. The sequel was at once unexpected and terrible. As the island was uninhabited, no one actually saw what took place, those nearest to the scene of the eruption having enough to do to save their own lives, while the dense clouds of vapor and dust baffled observation.

The phase of greatest violence set in on Sunday, August 26th. Soon after midday sailors on passing ships saw that the island had vanished behind a dense cloud of black vapor, the height of which was estimated at not less than seventeen miles. At intervals frightful detonations resounded, and after a time a rain of pumice began to fall at places ten miles distant. For miles round fierce flashes

of lightning rent the vapor, and at a distance of fully forty miles ghostly corposants gleamed on the rigging of a vessel.

These phenomena grew more and more alarming until August 27th, when four explosions of fearful intensity shook earth and sea and air, the third being "far the most violent and productive of the most widespread results." It was, in fact, perhaps the most tremendous volcanic outburst, in its intensity, known in human history. It seemed to overcome the obstruction to the energy of the internal forces, for the eruption now declined, and in a day or two practically died away, though one or two comparatively insignificant outbursts took place later.

FAR-REACHING DESTRUCTION

The eruption spread ruin and death over many surrounding leagues. At Krakatoa itself, when men once more reached its shores, everything was found to be changed. About two-thirds of the main island were blown completely away. The marginal cone was cut nearly in half vertically, the new cliff falling precipitously toward the centre of the crater. Where land had been before now sea existed, in some places more than one hundred feet deep. But the part of the island that remained had been somewhat increased in size by ejected materials.

Of the other islands and islets some had disappeared ; some were partially destroyed ; some were enlarged by fallen debris, while many changes had taken place in the depth of the neighboring sea-bed. Two new islands, Steers and Calmeyer, were formed. The ejected pumice, so cavernous in structure as to float upon the water, at places formed great floating islands which covered the sea for miles, and sometimes rose from four to seven feet above it, proving a serious obstacle to navigation. On vessels near by dust fell to

the depth of eighteen inches. The enormous clouds of volcanic dust which had been flung high into the air darkened the sky for a great area around. At Batavia, about a hundred miles from the volcano, it produced an effect not unlike that of a London fog. This began about seven in the morning of August 27th. Soon after ten the light had become lurid and yellow, and lamps were required in the houses; then came a downfall of rain, mingled with dust, and by about half-past eleven the town was in complete darkness. It soon after began to lighten, and the rain to diminish, and about three o'clock it had ceased.

At Buitenzorg, twenty miles further away, the conditions were similar, but lasted for a shorter time. In places much farther away the upper sky presented a strangely murky aspect, and the sun assumed a green color. Phenomena of this kind were traced over a broad area of the globe, even as far as the Hawaiian Islands, while over a yet wider area the sky after sunset was lit up by after-glows of extraordinary beauty. The height to which the dust was projected has been calculated from various data, with the result that 121,500 feet, or nearly 25 miles, is thought to be a probable maximum estimate, though it may be that occasional fragments of larger size were shot up to a still greater height.

A GRAPHIC DESCRIPTION OF THE ERUPTION

Another effect, of a distressing character, followed the eruption. A succession of enormous waves, emanating from Krakatoa, traversed the sea, and swept the coast bordering the Straits of Sunda with such force as to destroy many villages on the low-lying shores in Java, Sumatra and other islands. Some buildings at a height of fifty feet above sea-level were washed away, and in some places the water rose higher, in one place reaching the height of

115 feet. At Telok Betong, in Sumatra, a ship was carried inland a distance of nearly two miles, and left stranded at a height of thirty feet above the sea.

The eruption of Krakatoa seems to have been due to some deep-lying causes of extraordinary violence, this appearing not only in the terrible explosion which tore the island to fragments and sent its remnants as floating dust many miles high into the air, but also from an internal convulsion that affected many of the volcanoes of Java, which almost simultaneously broke into violent eruption. We extract from Dr. Robert Bonney's "Our Earth and its Story" a description of these closely-related events.

"The disturbances originated on the island of Krakatoa, with eruptions of red hot stones and ashes, and by noon next day Semeru, the largest of the Javanese volcanoes, was reported to be belching forth flames at an alarming rate. The eruption soon spread to Gunung Guntur and other mountains, until more than a third of the forty-five craters of Java were either in activity or seriously threatening it.

"Just before dusk a great cloud hung over Gunung Guntur, and the crater of the volcano began to emit enormous streams of white sulphurous mud and lava, which were rapidly succeeded by explosions, followed by tremendous showers of cinders and enormous fragments of rock, which were hurled high into the air and scattered in all directions, carrying death and destruction with them. The overhanging clouds were, moreover, so charged with electricity that water-spouts added to the horror of the scene. The eruption continued all Saturday night, and next day a dense cloud, shot with lurid red, gathered over the Kedang range, intimating that an eruption had broken out there.

"This proved to be the case, for soon after streams of lava poured down the mountain sides into the valleys, sweeping everything before them. About two o'clock on Monday morning—we are drawing on the account of an eye-witness—the great cloud suddenly broke into small sections and vanished. When light came it was seen that an enormous tract of land, extending from Point Capucin on the south, and Negery Passoerang on the north and west, to the lowest point, covering about fifty square miles, had been temporarily submerged by the 'tidal wave.' Here were situated the vilages of Negery and Negery Babawang. Few of the inhabitants of these places escaped death. This section of the island was less densely populated than the other portions, and the loss of life was comparatively small, although it must have aggregated several thousands. The waters of Welcome Bay in the Sunda Straits, Pepper Bay on the east, and the Indian Ocean on the south, had rushed in and formed a sea of turbulent waves.

DETONATIONS HEARD FOR MANY MILES AWAY

"On Monday night the volcano of Papandayang was in an active state of paroxysmal eruption, accompanied by detonations which are said to have been heard for many miles away. In Sumatra three distinct columns of flame were seen to rise from a mountain to a vast height, and its whole surface was soon covered with fiery lava streams, which spread to great distances on all sides. Stones fell for miles around, and black fragmentary matter carried into the air caused total darkness. A whirlwind accompanied the eruption, by which house-roofs, trees, men, and horses were swept into the air. The quantity of matter ejected was such as to cover the ground and the roofs of the houses at Denamo to the depth of several inches. Suddenly the scene changed. At first it was

reported that Papandayang had been split into seven distinct peaks. This proved untrue; but in the open seams formed could be seen great balls of molten matter. From the fissures poured forth clouds of steam and black lava, which, flowing in steady streams, ran slowly down the mountain sides, forming beds 200 or 300 feet in extent. At the entrance to Batavia was a large group of houses extending along the shore, and occupied by Chinamen. This portion of the city was entirely destroyed, and not many of the Chinese who lived on the swampy plains managed to save their lives. They stuck to their homes till the waves came and washed them away, fearing torrents of flame and lava more than torrents of water.

“Of the 3,500 Europeans and Americans in Batavia—which for several hours was in darkness, owing to the fall of ashes—800 perished at Anjer. The European and American quarter was first overwhelmed by rocks, mud and lava from the crater, and then the waters came up and swallowed the ruins, leaving nothing to mark the site, and causing the loss of about 200 lives of the inhabitants and those who sought refuge there.”

The loss of life above mentioned was but a small fraction of the total loss. All along the coasts of the adjoining large islands towns and villages were swept away and their inhabitants drowned, till the total loss was, as nearly as could be estimated, 36,000 souls. Krakatoa thus surpassed Mont Pelee in its tale of destruction. These two, indeed, have been the most destructive to life of known volcanic explosions, since the volcano usually falls far short of the earthquake in its murderous results.

The distant effects of this explosion were as remarkable as the near ones. The concussion of the air reached to an unprecedented distance and the clouds of floating dust encircled the earth,

producing striking phenomena of which an account is given at the end of this chapter.

The rapidity with which the effects of the Krakatoa eruption made themselves evident in all parts of the earth is perhaps the most remarkable outcome of this extraordinary event. The floating pumice reached the harbor of St. Paul on the 22nd of March, 1884, after having made a voyage of some two hundred and sixty days at a rate of six-tenths of a mile an hour. Immense quantities of pumice of a similar description, and believed to have been derived from the same source, reached Tamatave in Madagascar five months later, and no doubt much of it long continued to float round the world.

SERIES OF ATMOSPHERIC WAVES

Another result of the eruption was the series of atmospheric waves, caused by the disturbance in the atmosphere, which affected the barometer over the entire world. The velocity with which these waves traveled has been variously estimated at from 912.09 feet to 1066.29 feet per second. This speed is, of course, very much inferior to that at which sound travels through the air. Yet, in three distinct cases, the noise of the Krakatao explosions was plainly heard at a distance of at least 2,200 miles, and in one instance—that recorded from Rodriguez—of nearly 3,000. The sound travelled to Ceylon, Burmah, Manila, New Guinea and Western Australia, places, however, within a radius of about 2,000 miles; but Diego Garcia lies outside that area, and Rodriguez a thousand miles beyond it. Six days subsequent to the explosion, after the atmospheric waves had traveled four times round the globe, the barometer was still affected by them.

Another result, similar in kind, was the extraordinary dissemination of the great ocean wave, which in a like manner seems to have

encircled the earth, since high waves, without evident cause, appeared not only in the Pacific, but at many places on the Atlantic coast within a few days after the event. They were observed alike in England and at New York. The writer happened to be at Atlantic City, on the New Jersey coast, at this time. It was a period of calm, the winds being at rest, but, unheralded, there came in an ocean wave of such height as to sweep away the ocean-front boardwalk and do much other damage. He ascribed this strange wave at the time to the Krakatoa explosion, and is of the same opinion still.

In addition to the account given of this extraordinary volcanic event, it seems desirable to give Sir Robert S. Ball's description of it in his recent work, "The Earth's Beginnings." While repeating to some extent what we have already said, it is worthy, from its freshness of description and general readability, of a place here.

SIR ROBERT S. BALL'S DESCRIPTION

"Until the year 1883 few had ever heard of Krakatoa. It was unknown to fame, as are hundreds of other gems of glorious vegetation set in tropical waters. It was not inhabited, but the natives from the surrounding shores of Sumatra and Java used occasionally to draw their canoes up on its beach, while they roamed through the jungle in search of the wild fruits that there abounded. It was known to the mariner who navigated the Straits of Sunda, for it was marked on his charts as one of the perils of the intricate navigation in those waters. It was no doubt recorded that the locality had been once, or more than once, the seat of an active volcano. In fact, the island seemed to owe its existence to some frightful eruption of by-gone days; but for a couple of centuries there had been no fresh outbreak. It almost seemed as if

Krakatoa might be regarded as a volcano that had become extinct. In this respect it would only be like many other similar objects all over the globe, or like the countless extinct volcanoes all over the moon.

"As the summer of 1883 advanced the vigor of Krakatoa, which had sprung into notoriety at the beginning of the year, steadily increased and the noises became more and more vehement; these were presently audible on shores ten miles distant, and then twenty miles distant; and still those noises waxed louder and louder, until the great thunders of the volcano, now so rapidly developing, astonished the inhabitants that dwelt over an area at least as large as Great Britain. And there were other symptoms of the approaching catastrophe. With each successive convulsion a quantity of fine dust was projected aloft into the clouds. The wind could not carry this dust away as rapidly as it was hurled upward by Krakatoa, and accordingly the atmosphere became heavily charged with suspended particles.

"A pall of darkness thus hung over the adjoining seas and islands. Such was the thickness and density of these atmospheric volumes of Krakatoa dust that, for a hundred miles around, the darkness of midnight prevailed at midday. Then the awful tragedy of Krakatoa took place. Many thousands of the unfortunate inhabitants of the adjacent shores of Sumatra and Java were destined never to behold the sun again. They were presently swept away to destruction in an invasion of the shore by the tremendous waves with which the seas surrounding Krakatoa were agitated.

"As the days of August passed by the spasms of Krakatoa waxed more and more vehement. By the middle of that month the panic was widespread, for the supreme catastrophe was at hand. On the night of Sunday, August 26, 1883, the blackness of the

dust-clouds, now much thicker than ever in the Straits of Sunda and adjacent parts of Sumatra and Java, was only occasionally illumined by lurid flashes from the volcano.

“At the town of Batavia, a hundred miles distant, there was no quiet that night. The houses trembled with subterranean violence, and the windows rattled as if heavy artillery were being discharged in the streets. And still these efforts seemed to be only rehearsing for the supreme display. By ten o'clock on the morning of Monday, August 27, 1883, the rehearsals were over, and the performance began. An overture, consisting of two or three introductory explosions, was succeeded by a frightful convulsion which tore away a large part of the island of Krakatoa and scattered it to the winds of heaven. In that final outburst all records of previous explosions on this earth were completely broken.

AN EXTRAORDINARY NOISE

“This supreme effort it was which produced the mightiest noise that, so far as we can ascertain, has ever been heard on this globe. It must have been indeed a loud noise which could travel from Krakatoa to Batavia and preserve its vehemence over so great a distance; but we should form a very inadequate conception of the energy of the eruption of Krakatoa if we thought that its sounds were heard by those merely a hundred miles off. This would be little indeed compared with what is recorded on testimony which it is impossible to doubt.

“Westward from Krakatoa stretches the wide expanse of the Indian Ocean. On the opposite side from the Straits of Sunda lies the island of Rodriguez, the distance from Krakatoa being almost three thousand miles. It has been proved by evidence which cannot be doubted that the thunders of the great volcano attracted the

attention of an intelligent coast-guard on Rodriguez, who carefully noted the character of the sounds and the time of their occurrence. He had heard them just four hours after the actual explosion, for this is the time the sound occupied on its journey.

A CONSTANT WIND

“This mighty incident at Krakatoa has taught us other lessons on the constitution of our atmosphere. We previously knew little, or I might say almost nothing, as to the conditions prevailing above the height of ten miles overhead. It was Krakatoa which first gave us a little information which was greatly wanted. How could we learn what winds were blowing at a height four times as great as the loftiest mountain on the earth, and twice as great as the loftiest altitude to which a balloon has ever soared? No doubt a straw will show which way the wind blows, but there are no straws up there. There was nothing to render the winds perceptible until Krakatoa came to our aid. Krakatoa drove into those winds prodigious quantities of dust. Hundreds of cubic miles of air were thus deprived of that invisibility which they had hitherto maintained.

“With eyes full of astonishment men watched those vast volumes of Krakatoa dust on a tremendous journey. Of course, every one knows the so-called trade-winds on our earth’s surface, which blow steadily in fixed directions, and which are of such service to the mariner. But there is yet another constant wind. It was first disclosed by Krakatoa. Before the occurrence of that eruption, no one had the slightest suspicion that far up aloft, twenty miles over our heads, a mighty tempest is incessantly hurrying, with a speed much greater than that of the awful hurricane which once laid so large a part of Calcutta on the ground and slew so many of its

inhabitants. Fortunately for humanity, this new trade-wind does not come within less than twenty miles of the earth's surface. We are thus preserved from the fearful destruction that its unintermittent blasts would produce, blasts against which no tree could stand, and which would, in ten minutes, do as much damage to a city as would the most violent earthquake. When this great wind had become charged with the dust of Krakatoa, then, for the first, and, I may add, for the only time, it stood revealed to human vision. Then it was seen that this wind circled round the earth in the vicinity of the equator, and completed its circuit in about thirteen days.

A VAST CLOUD OF DUST

"The dust manufactured by the supreme convulsion was whirled round the earth in the mighty atmospheric current into which the volcano discharged it. As the dust-cloud was swept along by this incomparable hurricane it showed its presence in the most glorious manner by decking the sun and the moon in hues of unaccustomed splendor and beauty. The blue color in the sky under ordinary circumstances is due to particles in the air, and when the ordinary motes of the sunbeam were reinforced by the introduction of the myriads of motes produced by Krakatoa even the sun itself sometimes showed a blue tint. Thus the progress of the great dust-cloud was traced out by the extraordinary sky effects it produced, and from the progress of the dust-cloud we inferred the movements of the invisible air current which carried it along. Nor need it be thought that the quantity of material projected from Krakatoa should have been inadequate to produce effects of this world-wide description. Imagine that the material which was blown to the winds of heaven by the supreme convulsion of Krakatoa could be all recovered and swept into one vast heap. Imagine

that the heap were to have its bulk measured by a vessel consisting of a cube one mile long, one mile broad and one mile deep ; it has been estimated that even this prodigious vessel would have to be filled to the brim at least ten times before all the products of Krakatoa had been measured."

It is not specially to the quantity of material ejected from Krakatoa that it owes its reputation. Great as it was, it has been much surpassed. Professor Judd says that the great eruptions of Papapandayang, in Java, in 1772, of Skaptur Jökull, in Iceland, in 1783, and of Tamboro, in Sumbawa, in 1815, were marked by the extrusion of much larger quantities of material. The special feature of the Krakatoa eruption was its extreme violence, which flung volcanic dust to a height probably never before attained, and produced sea and air waves of an intensity unparalleled in the records of volcanic action. Judd thinks this was due to the situation of the crater, and the possible inflow through fissures of a great volume of sea water to the interior lava, the result being the sudden production of an enormous volume of steam.

EXTRAORDINARY RED SUNSETS

The red sunsets spoken of above were so extraordinary in character that a fuller description of them seems advisable. A remarkable fact concerning them is the great rapidity with which they were disseminated to distant regions of the earth. They appeared around the entire equatorial zone in a few days after the eruption, this doubtless being due to the great rapidity with which the volcanic dust was carried by the upper air current. They were seen at Rodriguez, 3,000 miles away, on August 28, and within a week in every part of the torrid zone. From this zone they spread north and south with less rapidity. Their first appearance in Australia was on September 15th, and at the Cape of Good Hope on

the 20th. On the latter day they were observed in California and the Southern United States. They were first seen in England on November 9th. Elsewhere in Europe and the United States they appeared from November 20th to 30th.

The effect lasted in some instances as long as an hour and three-quarters after sunset. In India the sun and skies assumed a greenish hue, and there was much curiosity regarding the cause of the "green sun." Another remarkable phenomenon of this period was the great prevalence of rain during the succeeding winter. This probably was due to the same cause; that is, to the fact of the air being so filled with dust; the prevailing theory in regard to rain being that the existence of dust in the air is necessary to its fall. The vapor of the air concentrates into drops around such minute particles, the result being that where dust is absent rain cannot fall.

As regards the sunsets spoken of, there are three similar instances on record. The first of these was in the year 526, when a dry fog covered the Roman Empire with a red haze. Nothing further is known concerning it. The other instances were in the years 1783 and 1831. The former of these has been traced to the great eruption of Skaptur Jökull in that year. It lasted for several months as a pale blue haze, and occasioned so much obscurity that the sun was only visible when twelve degrees above the horizon, and then it had a blood-red appearance. Violent thunderstorms were associated with it, thus assimilating it with that of 1883. Alike in 1783 and 1831 there was a pearly, phosphorescent gleam in the atmosphere, by which small print could be read at midnight. We know nothing regarding the meteorological conditions of 1831.

The red sunsets of 1883 were remarkable for their long persistence. They were observed in the autumn of 1884 with almost

their original brilliancy, and they were still visible in 1885, being seen at intervals, as if the dust was then distributed in patches, and driven about by the winds. In fact, similar sunsets were occasionally visible for several years afterwards. These may well have been due to the same cause, when we consider with what extreme slowness very fine dust makes its way through the air, and how much it may be affected by the winds.

THE RED SUNSETS DESCRIBED

One writer describes the appearance of these sunsets in the following terms : " Immediately after sunset a patch of white light appeared ten or fifteen degrees above the horizon, and shone for ten minutes with a pearly lustre. Beneath it a layer of bright red rested on the horizon, melting upward into orange, and this passed into yellow light, which spread around the lucid spot. Next the white light grew of a rosy tint, and soon became an intense rose hue. A vivid golden oriole yellow strip divided it from the red fringe below and the rose red above." This description, although exaggerated, represents the general conditions of the phenomenon.

On October 20th, 1884, the author observed the sunset effect as follows : ' Immediately after the sun had set, a broad cone of silvery lustre rested upon a horizon of smoky pink. After fifteen minutes the white became rose color above and yellowish below, deepening to lemon color, and finally into reddish tint, while the rose faded out. The whole cone gradually sank and died away in the brownish red flush on the horizon, more than an hour after sunset. The time of duration varied, since, on the succeeding evening, it lasted only a half-hour. These sunset effects, if we can justly attribute them all to the Krakatoa eruption, were extraordinary

not alone for their intensity and beauty but for their extended duration, the influence of this remarkable volcanic outbreak being visible for several years after the event.

Though no doubt is entertained concerning the cause of the red sunset effects of 1783 and 1883, that of 1831 is not so readily explained, there having been no known volcanic explosion of great intensity in that year. But in view of the fact that volcanoes exist in unvisited parts of the earth, some of which may have been at work unknown to scientific man, this difficulty is not insuperable. Possibly Mounts Erebus or Terror, the burning mountains of the Antarctic zone, may, unseen by man, have prepared for civilized lands this grand spectacular effect of Nature's doings.

CHAPTER XXIV.

Submarine Volcanoes and their Work of Island Building.

IN November, 1867, a volcano suddenly began to show signs of activity beneath the deep sea of the Pacific Ocean. There are some islands nearly two thousand miles to the east of Australia called the Navigator's Group, in which there had been no history of an eruption, nor had such an event been handed down by tradition. Most of the islands in the Pacific Ocean are old volcanoes, or are made up of rocks cast forth from extinct burning mountains. They rise up like peaks through the great depths of the ocean, and the top, which just appears above the sea-level, is generally encircled by a growth of coral. Hence they are termed coral islands. These islands every now and then rise higher than the sea-level, owing to some deep upheaving force, and then the coral is lifted up above the water, and becomes a solid rock. But occasionally the reverse of this takes place, and the islands begin to sink into the sea, owing to a force which causes the base of the submarine mountain to become depressed. Sometimes they disappear. All this shows that some great disturbing forces are in action at the bottom of the sea, and just within the earth's crust, and that they are of a volcanic nature.

For some time before the eruption in question, earthquakes shook the surrounding islands of the Navigator's Group, and caused great alarm, and when the trembling of the earth was very

great, the sea began to be agitated near one of the islands, and vast circles of disturbed water were formed. Soon the water began to be forced upwards, and dead fish were seen floating about. After a while, steam rushed forth, and jets of mud and volcanic sand. Moreover, when the steam began to rush up out of the water, the violence of the general agitation of the land and of the surface of the sea increased.

AN ERUPTION DESCRIBED

When the eruption was at its height vast columns of mud and masses of stone rushed into the air to a height of 2,000 feet, and the fearful crash of masses of rock hurled upwards and coming in collision with others which were falling attested the great volume of ejected matter which accumulated in the bed of the ocean, although no trace of a volcano could be seen above the surface of the sea. Similar submarine volcanic action has been observed in the Atlantic Ocean, and crews of ships have reported that they have seen in different places sulphurous smoke, flame, jets of water, and steam, rising up from the sea, or they have observed the waters greatly discolored and in a state of violent agitation, as if boiling in large circles.

New shoals have also been encountered, or a reef of rocks just emerging above the surface, where previously there was always supposed to have been deep water. On some few occasions, the gradual building up of an island by submarine volcanoes has been observed, as that of Sabrina in 1811, off St. Michael's, in the Azores. The throwing up of ashes in this case, and the formation of a conical hill 300 feet high, with a crater out of which spouted lava and steam, took place very rapidly. But the waves had the best of it, and finally washed Sabrina into the depths of the ocean.

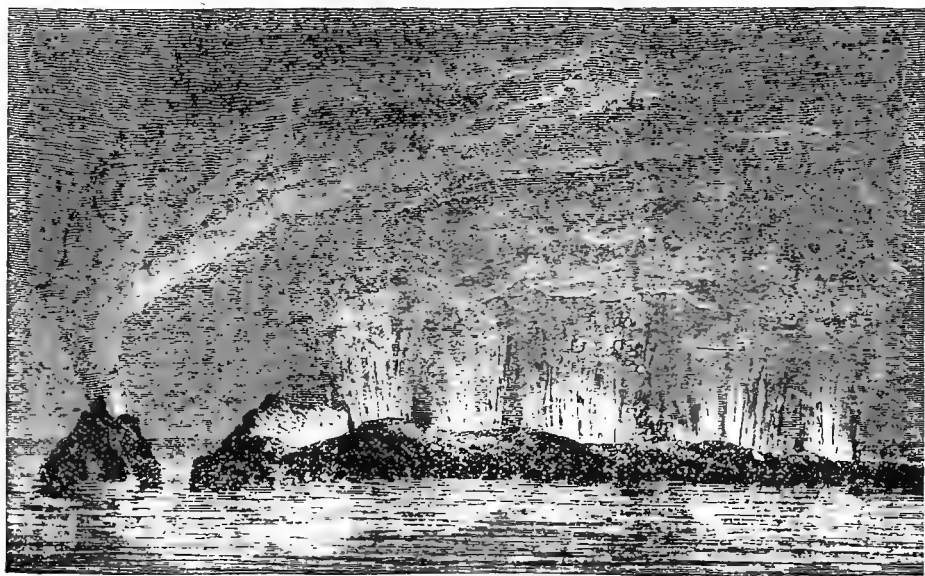
Previous eruptions in the same part of the sea were recorded as having happened in 1691 and 1720.

In 1831, a submarine volcanic eruption occurred in the Mediterranean Sea, between Sicily and that part of the African coast where Carthage formerly stood. A few years before, Captain Smyth had sounded the spot in a survey of the sea ordered by Government, and he found the sea-bottom to be under 500 feet of water. On June 28, about a fortnight before the eruption was visible, Sir Pulteney Malcom, in passing over the spot in his ship, felt the shock of an earthquake as if he had struck on a sandbank, and the same shocks were felt on the west coast of Sicily, in a direction from south-west to north-east.

BUILDING UP OF AN ISLAND BY SUBMARINE VOLCANOES

About July 10, the captain of a Sicilian vessel reported that as he passed near the place he saw a column of water like a water-spout, sixty feet high, and 800 yards in circumference, rising from the sea, and soon after a dense rush of steam in its place, which ascended to the height of 1,800 feet. The same captain, on his return eighteen days after, found a small island twelve feet high, with a crater in its centre, throwing forth volcanic matter and immense columns of vapor, the sea around being covered with floating cinders and dead fish. The eruption continued with great violence to the end of the same month. By the end of the month the island grew to ninety feet in height, and measured three-quarters of a mile round. By August 4th it became 200 feet high and three miles in circumference; after which it began to diminish in size by the action of the waves. Towards the end of October the island was levelled nearly to the surface of the sea.

Naval officers and foreign ministers alike took an absorbing interest in this new island. The strong national thirst for territory manifested itself and eager mariners waited only till the new land should be cool enough to set foot on to strive who should be first to plant there his country's flag. Names in abundance were given it by successive observers,—*Nerita*, *Sciacca*, *Fernandina*, *Julia*, *Hotham*, *Corrao*, and *Graham*. The last holds good in Eng-



GRAHAM'S ISLAND
Uplift of a Submarine Volcano

lish speech, and as *Graham's Island* it is known in books to-day, though the sea took back what it had given, leaving but a shoal of cinders and sand.

The Bay of Santorin, in the island of that name, which lies immediately to the north of Crete, has long been noted for its submarine volcanoes. According to one account, indeed, the whole island was at a remote period raised from the bottom of the sea;

but this is questionable. It is, with more reason, supposed that the bay is the site of an ancient crater, which was situated on the summit of a volcanic cone that subsequently fell in. Certain it is that islands have from time to time been thrown up by volcanic forces from the bottom of the sea within this bay, and that some of them have remained, while others have sunk again.

HOW AN ISLAND GREW

Of the existing islands, some were thrown up shortly before the beginning of the Christian era ; in particular, one called the Great Cammeni, which, however, received a considerable accession to its size by a fresh eruption in A. D. 726. The islet nearest Santorin was raised in 1573, and was named the Little Cammeni ; and in 1707 there was added, between the other two, a third, which is now called the Black Island. This made its appearance above water on the 23rd of May, 1707, and was first mistaken for a wreck ; but some sailors, who landed on it, found it to be a mass of rock ; consisting of a very white soft stone, to which were adhering quantities of fresh oysters. While they were collecting these, a violent shaking of the ground scared them away.

During several weeks the island gradually increased in volume ; but in July, at a distance of about sixty paces from the new islet, there was thrown up a chain of black calcined rocks, followed by volumes of thick black smoke, having a sulphurous smell. A few days thereafter the water all around the spot became hot, and many dead fishes were thrown up. Then, with loud subterraneous noises, flames arose, and fresh quantities of stones and other substances were ejected, until the chain of black rocks became united to the first islet that had appeared. This eruption continued for a long time, there being thrown out quantities of ashes and pumice, which

covered the island of Santorin and the surface of the sea—some being drifted to the coasts of Asia Minor and the Dardanelles. The activity of this miniature volcano was prolonged, with greater or less energy, for about ten years.

In 1866 similar phenomena took place in the Bay of Santorin, beginning with underground sounds and slight shocks of earthquake, which were followed by the appearance of flames on the surface of the sea. Soon after there arose, out of a dense smoke, a small islet, which gradually increased until in a week's time it was 60 feet high, 200 long and 90 wide. The people of Santorin named it "George," in honor of the King of Greece. In another week it joined and became continuous with the Little Cammeni. The detonations increased in loudness, and large quantities of incandescent stones were thrown up from the crater.

About the same time, at the distance of nearly 150 feet from the coast, to the westward of a point called Cape Phlego, there rose from the sea another island, to which was given the name of Aphroessa. It sank and reappeared several times before it established itself above water. The detonations and ejection of incandescent lava and stones continued at intervals during three weeks. From the crater of the islet George, which attained a height of 150 feet, some stones several cubic yards in bulk were projected to a great distance. One of them falling on board of a merchant vessel, killed the captain and set fire to the ship.

By the 10th of March the eruptions had partially subsided, but were then renewed, and a third island, which was named Reka, rose alongside of Aphroessa. They were at first separated by a channel sixty feet deep; but in three days this was filled up, and the two islets became united.

Reference may properly be made here to Monte Nuovo and Jorullo, not that they appertain to the present subject, but that they form examples of the action of similar forces, in the one instance exerted on a lake bottom, in the other on dry land, each yielding permanent volcanic elevations in every respect analogous to those which rise as islands from the bottom of the sea.

IN THE ICELANDIC SEAS

Off the coast of Iceland islands have appeared during several of the volcanic eruptions which that remote dependency of Denmark has manifested, and at various periods in Iceland's history the sea has been covered with pumice and other debris, which tell their own tale of what has been going on, without being in sufficient quantity to reach the surface in the form of an island mass. The sea off Reykjanes—Smoky Cape, as the name means—has been a frequent scene of these submarine eruptions. In 1240, during what the Icelandic historians describe as the eighth outburst, a number of islets were formed, though most of them subsequently disappeared, only to have their places occupied by others born at a later date. In 1422 high rocks of considerable circumference appeared. In 1783, about a month before the eruption of Skaptar Jökull, a volcanic island named Nyoe, from which fire and smoke issued, was built up. But in time it vanished under the waves, all that remains of it to-day being a reef from five to thirty-five fathoms below the sea-level. In 1830, after several long-continued eruptions of the usual character, another isle arose; while at the same time the skerries known as the Geirfuglaska disappeared, and with them vanished the great auks, or gare-fowls—birds now extinct—which up to that time had bred on them. At all events, though the auks could not well have been drowned, no traces of them were seen after the date mentioned.

In July, 1884, an island again appeared about ten miles off Reykjanes; but it is already beginning to diminish in size, and may soon disappear.

OFF THE COAST OF ALASKA

Elsewhere in the region of the northern seas there are other instances of the influence of the submarine forces in raising up and lowering land. The coast of Alaska is a region of intense volcanic action. In 1795, during a period of volcanic activity in the craters of Makushina, on Unalaska, and in others on Umnak Island, a volume of smoke was seen to rise out of the sea about 42 miles to the north of Unalaska, and the next year it was followed by a heap of cindery material, from which arose flame and volcanic matter, the glow being visible over a radius of ten miles. In four years the island grew into a large cone, 3000 feet above the sea-level, and two or three miles in circumference. Two years later it was still so hot that when some hunters landed on it they found the soil too warm for walking. It was named Ionna Bogoslova (St. John the Theologian), by the Russians, Agashagok by the Aleuts, and is now known to the whites of that region as Bogosloff. Mr. Dall believes that it occupies the site of some rocks that existed there as long as tradition extends.

There were additions to the cone up to the year 1823, when it became so quiescent as to be the favorite haunt of seals and sea-fowls, and, when the weather was favorable, was visited by native egg-hunters from Unalaska. During the summer of 1883 Bogosloff was again seen in eruption, as it was thought. However, on closely examining the neighborhood, it was found that the old island was undisturbed, but that there had been a fresh eruption, which had resulted in the extension of Bogosloff by the appearance of a cone and crater (Hague Volcano), 357 feet high, connected

with the parent island by a low sand-spit, and situated in a spot where, the year before, the lead showed 800 fathoms of water. At the same time Augustin and two other previously quiet islands on the peninsula of Alaska began simultaneously to emit smoke, dust and ashes, while a reef running westward and formerly submerged became elevated to the sea surface. Other islands, of origin exactly similar to Bogosloff and those mentioned, are to be found in this region, notably Koniugi and Kasatochi, in the western Aleutians, and Pinnacle Island, near St. Matthew Island. Indeed, the volcano of Kliutchevsk, which rises to a height of over 15,000 feet, is really a volcanic island.

A permanent addition was made to the Aleutian group of Islands by the action of a submarine volcano in 1806. This new island has the form of a volcanic peak, with several subsidiary cones. It is four geographical miles in circumference. In 1814 another arose out of the sea in the same archipelago, the cone of which attained a height of 3,000 feet; but at the end of a year it lost a portion of this elevation.

In 1856, in the sea in the same neighborhood, Captain Newell, of the whaling bark *Alice Fraser*, witnessed a submarine eruption, which was also seen by the crews of several other vessels. There was no island formed on this occasion, but large jets of water were thrown up, and the sea was greatly agitated all around. Then followed volcanic smoke, and quantities of stones, ashes, and pumice; the two latter being scattered over the surface of the sea to a great distance. Loud thundering reports accompanied this eruption, and all the ships in the neighborhood felt concussions like those produced by an earthquake. These phenomena seem to have ended in the formation of some great submarine chasm, into which the waters rushed with extreme violence and a terrific roar.

Occurrences similar to this last have been several times observed in a tract of open sea in the Atlantic, about half a degree south of the equator, and between 20° and 22° of west longitude. Although quantities of volcanic dross have been from time to time thrown up to the surface in this region, no island has yet made its appearance above water.

The events here described repeat on a far smaller scale similar ones which have occurred in remote ages in many parts of the ocean and left great island masses as the permanent effects of their work. We may instance the Hawaiian group, which is wholly of volcanic origin, with the exception of its minor coral additions, and represents a stupendous activity of underground agencies beneath the domain of Father Neptune.

In part, as we have said elsewhere in this work, all oceanic islands, remote from those in the shoal bordering waters of the continents, have been of volcanic or coral formation, or more often a combination of the two. No sooner does an island mass appear above or near the surface of tropical waters than the minute coral animals—effective only by their myriads—begin their labors, building fringes of coral rock around the cindery heaps lifted from the ocean floor. The atolls of the Pacific—circular or oval rings of coral with lagunes of sea-water within—have long been thought to be built on the rims of submarine volcanoes, rising to within a few hundred feet of the surface, much as coral reefs around actual islands. If the volcanic mass should subsequently subside, as it is likely to do, the minute ocean builders will continue their work—unless the subsidence be too rapid for their powers of production—and in this way ring-like islands of coral may in time rise from great depths of sea, their basis being the volcanic island which has sunk from near the surface far toward old ocean's primal floor.

CHAPTER XXV.

Mud Volcanoes, Geysers, and Hot Springs.

OUR usual impression of a volcano is indicated in the title of "burning mountain," so often employed, a great fire-spouting cone of volcanic debris, from which steam, lava, rock-masses, cinder-like fragments, and dust, often of extreme fineness, are flung high into the air or flow in river-like torrents of molten rock. This, no doubt, applies in the majority of cases, but the volcanic forces do not confine themselves to these magnificent displays of energy, nor are their products limited to those above specified. We have seen that mud is a not uncommon product, due to the mingling of water with volcanic dust, while water alone is occasionally emitted, of which we have a marked instance in the Volcan de Agua, of Guatemala, already mentioned. As regards mud flows, we may specially instance the first outflow from Mont Pelee, that by which the Guerin sugar works were overwhelmed.

The imprisoned forces of the earth have still other modes of manifestation. A very frequent one of these, and the most destructive to human life of them all, is the earthquake.

Minor manifestations of volcanic action may be seen in the geyser and the hot spring, the latter the most widely disseminated of all the resultant effects of the heated condition of the earth's interior. It is these displays of subterranean energy, differing from those usually termed volcanic, yet due to the same general causes, that we have next to consider. And it may be premised that their

manifestations, while, except in the case of the earthquake, less violent, are no less interesting, especially as the minor displays are free from that peril to human life which renders the major ones so terrible.

While the largest volcanoes at times pour out rivers of liquid mud, there are volcanoes from which nothing is ever ejected but mud and water, the latter being generally salt. From this circumstance they are sometimes called *saltes*, but they are more generally termed mud-volcanoes. Some varieties of them throw out little else than gases of different sorts, and these are called air-volcanoes.

THE GREAT MUD VOLCANO OF SICILY

One of the best known mud-volcanoes is at Macaluba, near Girgenti, in Sicily. It consists of several conical mounds, varying from time to time in their form and height, which ranges from eight to thirty feet. From orifices on the tops of these mounds there are thrown out sometimes jets of warmish water and mud mixed with bitumen, sometimes bubbles of gas, chiefly carbonic acid and carburetted hydrogen, occasionally pure nitrogen. The mud ejected has often a strong sulphurous smell. The jets in general ascend only to a moderate height; but occasionally they are thrown up with great violence, attaining a height of about 200 feet. In 1777 there was ejected an immense column, consisting of mud strongly impregnated with sulphur and mixed with naphtha and stones, accompanied also by quantities of sulphurous vapors. This mud-volcano is known to have been in action for fifteen centuries.

Very recently a small mud-volcano has been formed on the flanks of Mount Etna. It began with the throwing up of jets of boiling water, mixed with petroleum and mud, great quantities of gas bubbling up at the same time. In several of the valleys of

Iceland there are similar phenomena, the boiling water and mud being thrown up in jets to the height of fifteen feet and upwards, the mud accumulating around the orifices whence the jets arise.

A mud-volcano named Korabetoff, in the Crimea, presents phenomena more akin to those of the igneous volcanoes of South America. There was an eruption from this mountain on the 6th of August, 1853. It began by throwing up from the summit a column of fire and smoke, which ascended to a great height. This continued for five or six minutes, and was followed at short intervals by two similar eruptions. There was then ejected with a hissing noise a quantity of black fetid mud, which was so hot as to scorch the grass on the edges of the stream. The mud continued to pour out for three hours, covering a wide space at the mountain's base. The mud-volcanoes on the coast of Beloochistan are very numerous, and extend over an area of nearly a thousand square miles. Their action resembles that at Macaluba.

THE MUD VOLCANO OF JAVA

There is a mud volcano in Java which is of interest as somewhat resembling the geyser in its mode of operation and apparently due to similar agencies. It is thus described by Dr. Horsfield :—

“On approaching it from a distance, it is first discovered by a large volume of smoke, rising and disappearing at intervals of a few seconds, resembling the vapors rising from a violent surf. A loud noise is heard, like that of distant thunder. Having advanced so near that the vision was no longer impeded by the smoke, a large hemispherical mass was observed, consisting of black earth mixed with water, about sixteen feet in diameter, rising to the height of twenty or thirty feet in a perfectly regular manner, and as if it were pushed up by a force beneath, which suddenly exploded with a loud

noise, and scattered about a volume of black mud in every direction. After an interval of two or three, or sometimes four or five seconds, the hemispherical body of mud rose and exploded again. In the manner stated this volcanic ebullition goes on without interruption, throwing up a globular body of mud, and dispersing it with violence through the neighboring plain. The spot where the ebullition occurs is nearly circular, and perfectly level. It is covered only with the earthy particles, impregnated with salt water, which are thrown up from below. The circumference may be estimated at about half an English mile. In order to conduct the salt water to the circumference, small passages or gutters are made in the loose muddy earth, which lead to the borders, where it is collected in holes dug in the ground for the purpose of evaporation."

The mud has a strong, pungent, sulphurous smell, resembling that of mineral oil, and is hotter than the surrounding atmosphere. During the rainy season the explosions increase in violence.

There are submarine mud volcanoes as well as those of igneous kind. In 1814 one of this character broke out in the Sea of Azof, beginning with flame and black smoke, accompanied by earth and stones, which were flung to a great height. Ten of these explosions occurred, and, after a period of rest, others were heard during the night. The next morning there was visible above the water an island of mud some ten feet high. A very similar occurrence took place in 1827, near Baku, in the Caspian sea. This began with a flaming display and the ejection of great fragments of rock. An eruption of mud succeeded. A set of small volcanoes discovered by Humboldt in Turbaco, in South America, confined their emissions almost wholly to gases, chiefly nitrogen.

There is a close connection in character between mud volcanoes and those intermittent boiling springs named geysers. A good many

of the mud volcanoes throw out jets of boiling water along with the mud; but in the case of the geysers, the boiling water is ejected alone, without any visible impregnation, though some mineral in solution, as silica, carbonate of lime, or sulphur, is usually present.

THE GEYSER IS A WATER VOLCANO

The phenomenon of the geyser serves in a measure to support the theory that steam is an important agent in volcanic action. A geyser, in fact, may be designated as a water volcano, since it throws up water only. It comprises a cone or mound, usually only a few feet high. In the middle of this is a crater-like opening with a passage leading down into the earth. As in the case of the volcano, the geyser cone is built up by its own action. In the boiling water which is ejected there is dissolved a certain amount of silica. As the water falls and cools this mineral is deposited, gradually building up a cup-like elevation. The basin of the geyser is generally full of clear water, with a little steam rising from its surface; but at intervals an eruption takes place, sometimes at regular periods, but more often at irregular intervals.

Among the largest and best known geysers in the world are those of Iceland, chief among them being the Great Geyser. Silica is the mineral with which the waters of this fountain are impregnated, and the substance which they deposit, as they slowly evaporate, is named siliceous sinter. Of this material is composed the mound, six or seven feet high, on which the spring is situated. On the top of the mound is a large oval basin, about three feet in depth, measuring in its larger diameter about fifty-six, and in its shorter about forty-six feet. The centre of this basin is occupied by a circular well about ten feet in diameter, and between seventy and eighty feet deep.

Out of the central well springs a jet of boiling water, at intervals of six or seven hours. When the fountain is at rest, both the basin and the well appear quite empty, and no steam is seen. But on the approach of the moment for action, the water rises in the well, till it flows over into the basin. Then loud subterranean explosions are heard, and the ground all round is violently shaken.

Instantly, and with immense force, a steaming jet of boiling water, of the full width of the well, springs up and ascends to a great height in the air. The top of this large column of water is enveloped in vast clouds of steam, which diffuse themselves through the air, rendering it misty. These jets succeed each other with great rapidity to the number of sixteen or eighteen, the period of action of the fountain being about five minutes. The last of the jets generally ascends to the greatest height, usually to about 100, but sometimes to 150 feet; on one occasion it rose to the great height of 212 feet. Having ejected this great column of water, the action ceases, and the water that had filled the basin sinks down into the well. There it remains till the time for the next eruption, when the same phenomena are repeated. It has been found that, by throwing large stones into the well, the period of the eruption may be hastened, while the loudness of the explosions and the violence of the fountain effect are increased, the stones being at the same time ejected with great force.

ERUPTION CAN BE INDUCED BY ARTIFICIAL MEANS

Geysers are found all over the island, presenting various peculiarities. In the case of one of the smaller ones, which is called *Strokr*, or the Churn, an eruption can be induced by artificial means. A barrow-load of sods is thrown into the crater of the geyser, with the effect of causing an eruption. The sensitiveness of *Strokr* is

due to its peculiar form. An observer states that, "The bore is eight feet in diameter at the top, and forty-four feet deep. Below twenty-seven feet it contracts to nineteen inches, so that the turf thrown in completely chokes it. Steam collects below ; a foaming scum covers the surface of the water, and in a quarter of an hour it surges up the pipe. The fountain then begins playing, sending its bundles of jets rather higher than those of the Great Geyser, flinging up the clods of turf which have been its obstruction like a number of rockets. This magnificent display continues for a quarter of an hour or twenty minutes. The erupted water flows back into the pipe from the curved sides of the bowl. This occasions a succession of bursts, the last expiring effort, very generally, being the most magnificent. Strokr gives no warning thumps, like the Great Geyser, and there is not the same roaring of steam accompanying the outbreak of the water."

The same author thus describes an eruption of the Great Geyser, which occurred about two o'clock in the morning : "A violent concussion of the ground brought me and my companions to our feet. We rushed out of the tent in every condition of dishabille and were in time to see Geyser put forth his full strength. Five strokes underground were the signal, then an overflow, wetting every side of the mound. Presently a dome of water rose in the centre of the basin and fell again, immediately to be followed by a fresh bell, which sprang into the air fully forty feet high, accompanied by a roaring burst of steam. Instantly the fountain began to play with the utmost violence, a column rushing up to the height of ninety or one hundred feet against the gray night sky, with mighty volumes of white steam cloud rolling after it and swept off by the breeze to fall in torrents of hot rain. Jets and lines of water tore their way through the clouds, or leaped high

above its domed mass. The earth trembled and throbbed during the explosion, then the column sank; started up again, dropped once more, and seemed to be sucked back into the earth. We ran to the basin, which was left dry, and looked down the bore at the water, which was bubbling at the depth of six feet."

In the case of Strokr, the cause of this eruption is not difficult to understand. The narrow part of the channel is choked up by the turf and the steam, and prevented from escaping. Finally it gains such force as to drive out the obstacle with a violent explosion, just as a bottle of fermenting liquor may blow out the cork and discharge some of its contents.

Geysers are somewhat abundant phenomena, existing in many parts of the earth, while striking examples of them are found in the widely separated regions of Iceland, New Zealand, Japan and the western United States. In the volcanic region of New Zealand geysers and their associated hot springs are abundant. It was to their action that we owed the famous white and pink terraces and the warm lake of Rotomahana which were ruined by the destructive eruption of Mount Tarawera, already described.

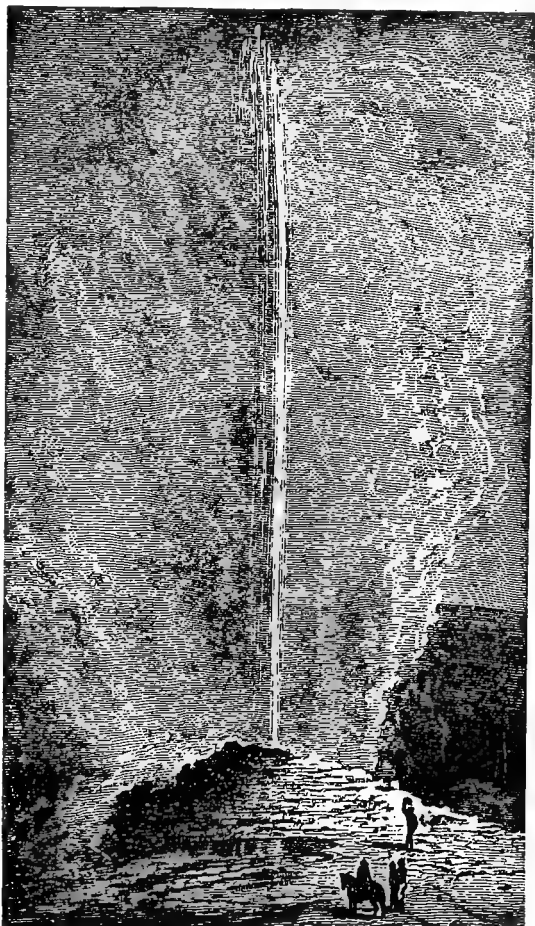
GEYSERS OF THE UNITED STATES

The United States is abundantly supplied with hot springs, but geysers, outside of the Yellowstone region, are found only in California and Nevada. Those of California exist chiefly in Napa Valley, north of San Francisco, in a canon or defile. Their waters are impregnated not with silica, but with sulphur, and they thus approach more nearly in their character to mud-volcanoes, whose ejections are, in like manner, much impregnated with that substance. They are also, like them, collected in groups, there being no less than one hundred openings within a space of flat ground a

mile square. Owing to their number and proximity, their individual energy is nothing like so violent as that of the geysers of Iceland. Their jets seldom rise higher than 20 or 30 feet; but so great a number playing within so confined a space produces an imposing effect. The jets of boiling water issue with a loud noise from little conical mounds, around which the ground is merely a crust of sulphur. When this crust is penetrated, the boiling water may be seen underneath. The rocks in the neighborhood of these fountains are all corroded by the action of the sulphurous vapors. Nevertheless, within a distance of not more than 50 feet from them, trees grow without injury to their health.

Few of these fountains, however, are regular geysers, most of them discharging only steam.

From the Steamboat Geyser this ascends to a height of from 50 to 100 feet, with a roar like that of the escape from a steamboat boiler. Associated with the geysers are numerous hot springs.



A GEYSER IN ERUPTION, YELLOWSTONE
NATIONAL PARK.

some clear, some turbid, and variously impregnated with iron, sulphur or alum. In Nevada the Steamboat Springs, as they are designated, exist in Washoe Valley, east of the Virginian range. They come nearer in character to the Yellowstone geysers, their waters depositing true geyserite, or silicious concretions. The Volcano Springs, in Lauder County, are also true geysers, though of small importance. The ground here is so thickly perforated by holes from which steam escapes that it looks like a cullender.

THE YELLOWSTONE GEYSERS

The most remarkable geyser country in the world, alike for the size and the number of its spouting fountains, is the Yellowstone region in the northwest part of the Territory of Wyoming, in the United States, which, by a special act of Congress, has been reserved as the Yellowstone National Park, exempt from settlement, purchase or pre-emption. Here nearly every form of geyser and unintermittent hot spring occurs, with deposits of various kinds, silicious, calcareous, etc. Of the hot springs, Dr. Peale enumerates 2,195, and considers that within the limits of the park—which is about 54 miles by 62 miles, and includes 3,312 square miles—as many as 3,000 actually exist. The same geologist notes the existence of 71 geysers in the area mentioned, though some of the number are only inferred to be spouting springs from the form of their basins and the character of the surrounding deposits. Of this vast collection of still and eruptive springs, between which there seems every gradation, those which do not send water into the air are, owing to the magnificent cascades which they form, often quite as remarkable as those which take the shape of geysers. The more striking of the latter may, however, be briefly mentioned.

STREET SCENE IN KINGSTOWN, ST. VINCENT





RIVER RUN IN ST. PIERRE, THROUGH WHICH THE MOLTEN LAVA AND ASHES
FLOWED IMMEDIATELY AFTER THE ERUPTION

Digitized by Microsoft®

THE STREET CALLED VICTOR HUGO, IN ST. PIERRE, MARTINIQUE







THE HARBOR OF ST. PIERRE, MARTINIQUE

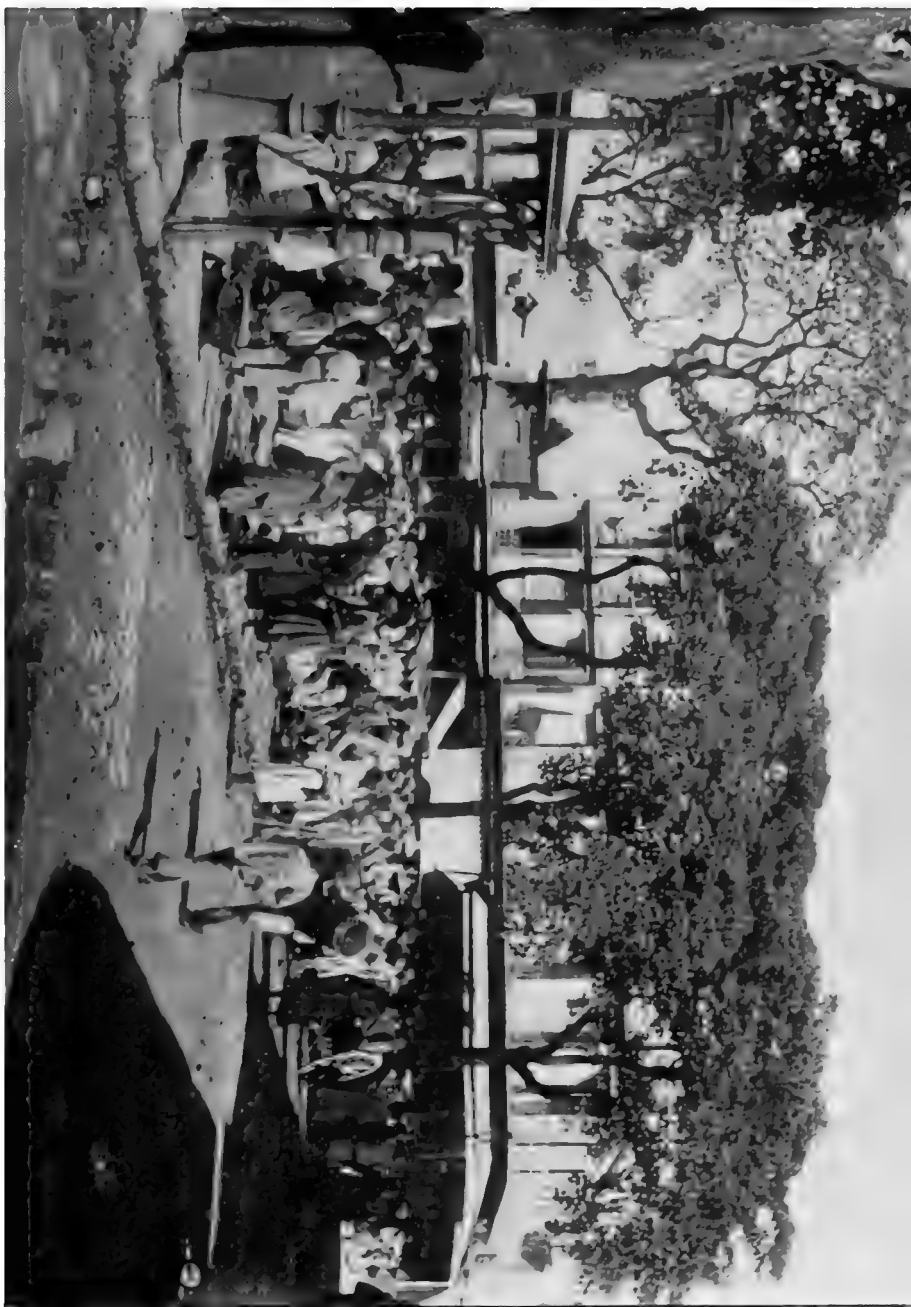
Showing the Bay and the Roofs of the Houses which were Overwhelmed with Ashes and Lava



MOUNT PELEE, MARTINIQUE

Showing one of the large Plantations at the Base of the Mountain, which was in the Path of the Fiery Stream.
Copyright, J. Murray Jordan.

THE MARKET PLACE IN GUADELOUPE
Giving a Characteristic and Typical View of What May be Seen on any of the Windward Islands.





THE FORTIFICATIONS, FORT DE FRANCE, MARTINIQUE

In the Gibbon Basin is a geyser of late origin. In 1878 this consisted of two steam holes, roaring on the side of a hill, that looked as if they had recently burst through the surface ; and the gully leading towards the ravine was at that date filled with sand, which appeared to have been poured out during an eruption. Dead trees stood on the line of this sand floor, and others, with their bark still remaining, and even with their foliage not lost, were uprooted hard by, everything indicating that the "steamboat vent," as it was called, was of recent formation. In 1875 it had no existence, but in 1879 the spouting spring—which first opened, it is believed, on the 11th of August in the preceding year—had "settled down to business as a very powerful flowing geyser," with a double period ; one eruption occurring every half hour, and projecting water to the height of 30 feet ; the main eruption occurring every six or seven days, with long continued action, and a column of nearly 100 feet.

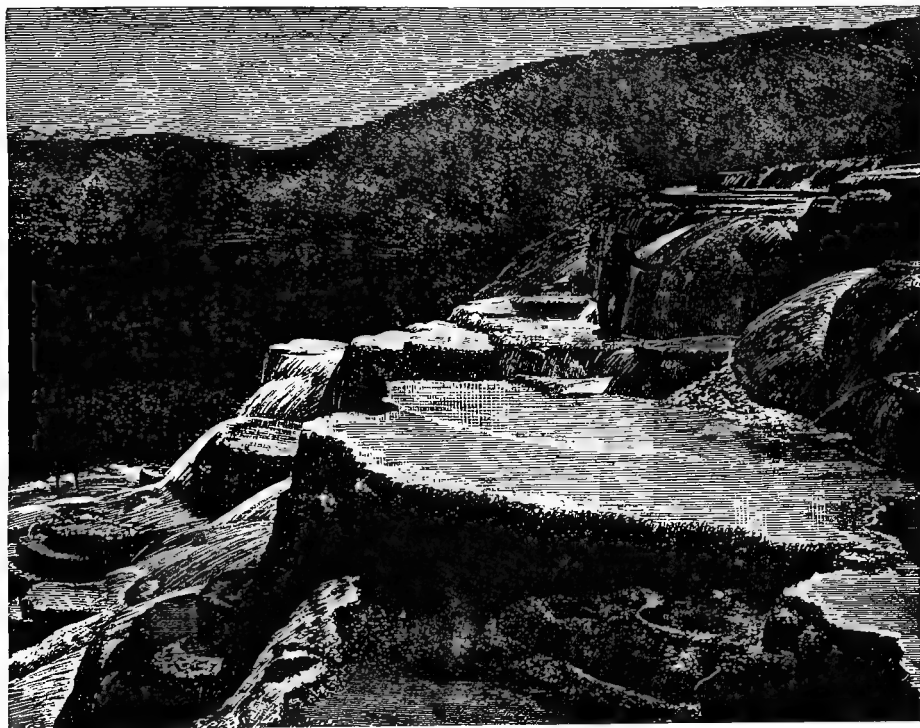
The New Geyser in the same basin is also of quite recent origin. It consists of two fissures in the rock, in which the water boils vigorously. But there is no mound, and the rocks of the fissure are just beginning to get a coating of the silicious geyserite deposited from the water, so that it cannot long have been spouting. Again, in the Grotto Geyser—in the Upper Geyser Basin of Fire Hole River—the main or larger crater is hollowed into fantastic arches, beneath which are the grotto-like cavities from which it is named, which act as lateral orifices for the escape of water during an eruption. It plays several times in the course of the twenty-four hours, and sends a column of water sixty feet high, the eruption lasting an hour. As yet, however, the force of the water has not been sufficient, or of sufficiently long duration, to break through the arches covering the basin or crater. The Excelsior—claimed to be the largest of its order, which sent water nearly 300 feet into

the air at intervals of about five hours, and of such volume as to wash away bridges over small streams below—was not, until comparatively recent years, known as a specially powerful geyser. But if it had for a time waned in importance, its immense crater, 330 feet in length and 200 feet at the widest part, shows that at a still earlier date it was a gigantic fountain. In this deep pit, when the breeze wafted aside the clouds of steam constantly arising from its surface, the water could be seen seething 15 or 20 feet below the surrounding level. Yet into the cauldron of boiling water a little stream of cold water, from the melting snow of the uplands, ran unceasingly. Since 1888 this great geyser has been inactive.

The Castle Geyser is so named on account of the fancied resemblance which its mound of white and grey deposit presents to the ruins of a feudal keep, the crater itself being placed on a cone or turret, which has a somewhat imposing appearance compared with the other geysers in the neighborhood. It throws a column usually about fifty or sixty feet high, at intervals of two or three hours, but sometimes the discharge shoots up much higher.

The Giant, in the Upper Geyser Basin, has a peculiar crater, which has been likened to the stump of a hollow sycamore tree of gigantic proportions, whose top has been wrenched off by a storm. This curious cup is broken down at one side, as though it had been torn away during an eruption of more than ordinary violence, and on this side the visitor is able to look into the crater, if he can contrive to avoid the jets which are constantly spouted from it. The periods of rest which it takes are varied, an eruption often not occurring for several days at a time; yet when it breaks out it continues playing for more than three hours, with a volume of water reaching a height of from 130 to 140 feet. In the interval little spouts are constantly in progress. Mr. Stanley saw one eruption

which he calculated to have shot a column of water to the height of more than 200 feet. At first it seemed as though the geyser was only making a feint, the discharge which preceded the great one being merely repeated several times, followed by a cessation both of the rumbling noises and of the ejection of water. But



THE FAMOUS TERRACES OF YELLOWSTONE NATIONAL PARK

soon, after a premonitory cloud of steam, the geyser began to work in earnest, the column discharged rising higher and higher, until it reached the altitude mentioned.

'At first it appeared to labor in raising the immense volume, which seemed loath to start on its heavenward tour; but it was with perfect ease that the stupendous column was held to its place,

the water breaking into jets and returning in glittering showers to the basin. The steam ascended in dense volumes for thousands of feet, when it was freighted on the wings of the winds and borne away in clouds. The fearful rumble and confusion attending it were as the sound of distant artillery, the rushing of many horses to battle, or the roar of a fearful tornado. It commenced to act at 2 P. M., and continued for an hour and a half, the latter part of which it emitted little else than steam, rushing upward from its chambers below, of which, if controlled, there was enough to run an engine of wonderful power. The waving to and fro of such a gigantic fountain, when the column is at its highest,

‘Tinselled o’er in robes of varying hues’,

and glistening in the bright sunlight, which adorns it with the glowing colors of many a gorgeous rainbow, affords a spectacle so wonderful and grandly magnificent, so overwhelming to the mind, that the ablest attempt at description gives the reader who has never witnessed such a display but a feeble idea of its glory.”

A DESCRIPTION OF THE GEYSER AT WORK

The only other geysers in this remarkable geyserland which we can spare room to notice are those known as the Giantess, the Beehive, and the Grand. The Giantess sends a column of water to the height of 250 feet. An eruption is usually divided into three periods—two preliminary efforts and a final one, divided from each other by intervals of between one and two hours, while the intervals of discharge are very long. Sometimes it does not play for several weeks. The Beehive, which is 400 feet from the Giantess, gets its name from the peculiar beehive-like cone which it has formed. The eruption is also almost unique. It is heralded by a slight escape of steam, which is followed by a column of steam

and water, shooting to the height of over 200 feet. The column is somewhat fan-shaped, but it does not fall in rain, the spray being evaporated and carried off as steam—if, indeed, there is not more steam than water in the column. The duration of the discharge is between four and five minutes, and the interval between two eruptions from twenty-one to twenty-five hours.

The Grand is one of the most important in the Upper Geyser basin. Yet, unlike the Grotto, the Giant, or the Old Faithful,—so called from its frequent and regular eruptions—it has no raised cone or crater, and a much less cavernous bowl than the Giantess and other geysers. The column discharged ascends to the height of from eighty to two hundred feet, and the eruptions last from fifteen minutes to three-quarters of an hour, with intervals on an average of from seven to twenty hours. This fountain is apparently very irregular in its action, though it is just possible that when the Yellowstone geysers have been more consecutively studied, it will be found that these seeming irregularities depend on the varying supplies of water at different times of the year.

THE MAMMOTH HOT SPRINGS

The marvellous phenomena of the Yellowstone region are not confined to geyser action, hot springs of steady flow being, as above stated, exceedingly numerous. Of these the most striking are those known as the Mammoth Hot Springs, whose waters find their way through underground passages, finally flowing from an opening as the “Boiling River,” which empties into the Gardiner River.

These springs are marvels of beauty. Their terraced bowls, adorned with delicate fret-work, are among the finest specimens of Nature’s handiwork in the world, and the colored waters themselves are startling in their brilliancy. Red, pink, black, canary, green,

saffron, blue, chocolate, and all their intermediate gradations are found here in exquisite harmony. The springs rise in terraces of various heights and widths, having intermingled with their delicate shades chalk-like cliffs, soft and crumbly, these latter being the remains of springs from which the life and beauty have departed. The great spring is the largest in the country, the water flowing through three openings into a basin forty feet long by twenty-five feet wide. From this the hot mineral waters drip over into lower basins, of gracefully curved and scalloped outline, the minerals deposited on the lips of the basin forming stalagmites of variegated hue, yielding a brilliant and beautiful effect. The terraced basins bear a close resemblance to the former New Zealand pink and white terraces, and since the latter are the most charming examples in existence of this rare form of Nature's artistic handiwork.

CHAPTER XXIII.

Theories of Volcanic and Earthquake Action.

THOUGH the first formation of a volcano (Italian, *vulcano*, from Vulcan, the Roman god of fire) has seldom been witnessed, it would seem that it is marked by earthquake movements followed by the opening of a rent or fissure ; but with no such tilting up of the rocks as was once supposed to take place. From this fissure large volumes of steam issue, accompanied by hydrogen, nitrogen, carbon dioxide, hydrochloric acid, and sulphur dioxide. The hydrogen, apparently derived from the dissociation of water at a high temperature, flashes explosively into union with atmospheric oxygen, and, having exerted its explosive force, the steam condenses into cloud, heavy masses of which overhang the volcano, pouring down copious rains. This naturally disturbs the electrical condition of the atmosphere, so that thunder and lightning are frequent accompaniments of an eruption. The hydrochloric acid probably points to the agency of sea-water. Besides the gases just mentioned, sulphuretted hydrogen, ammonia and common salt occur ; but mainly as secondary products, formed by the union of the vapors issuing from the volcano, and commonly found also in the vapors rising from cooling lava streams or dormant volcanic districts. It is important to notice that the vapors issue from the volcano spasmodically, explosions succeeding each other with great rapidity and noise.

All substances thrown out by the volcano, whether gaseous, liquid or solid, are conveniently united under the term *ejectamenta*

(Latin, things thrown out), and all of them are in an intensely heated, if not an incandescent state. Most of the gases are incom-bustible, but the hydrogen and those containing sulphur burn with a true flame, perhaps rendered more visible by the presence of solid particles. Much of the so-called flame, however, in popular descrip-tions of eruptions is an error of observation due to the red-hot solid particles and the reflection of the glowing orifice on the over-hanging clouds.

ENORMOUS FORCE DISPLAYED

Solid bodies are thrown into the air with enormous force and to proportionally great heights, those not projected vertically fall-ing in consequence at considerable distances from the volcano. A block weighing 200 tons is said to have been thrown nine miles by Cotopaxi; masses of rock weighing as much as twenty tons to have been ejected by Mount Ararat in 1840; and stones to have been hurled to a distance of thirty-six miles in other cases. The solid matter thrown out by volcanoes consists of *lapilli*, *scoriæ*, *dust* and *bombs*.

Though on the first formation of the volcano, masses of non-volcanic rock may be torn from the chimney or pipe of the mountain, only slightly fused externally owing to the bad conducting power of most rocks, and hurled to a distance; and though at the begin-ning of a subsequent eruption the solid plug of rock which has cooled at the bottom of the crater, or, in fact, any part of the volcano, may be similarly blown up, the bulk of the solid particles of which the volcano itself is composed is derived from the lake of lava or molten rock which seethes at the orifice. Solid pieces rent from this fused mass and cast up by the explosive force of the steam with which the lava is saturated are known as *lapilli*. Cooling

rapidly so as to be glassy in texture externally, these often have time to become perfectly crystalline within.

Gases and steam escaping from other similar masses may leave them hollow, when they are termed *bombs*, or may pit their surfaces with irregular bubble-cavities, when they are called *scoriæ* or *scoriaceous*. Such masses whirling through the air in a plastic state often become more or less oblately spheroidal in form; but, as often, the explosive force of their contained vapors shatters them into fragments, producing quantities of the finest volcanic dust or sand. This fine dust darkens the clouds overhanging the mountain, mixes with the condensed steam to fall as a black mud-rain, or *lava di aqua* (Italian, water lava), or is carried up to enormous heights, and then slowly diffused by upper currents of the atmosphere. In the eruption of Vesuvius of A.D. 79, the air was dark as midnight for twelve or fifteen miles round; the city of Pompeii was buried beneath a deposit of dry *scoriæ*, or ashes and dust, and Herculaneum beneath a layer of the mud-like *lava di aqua*, which on drying sets into a compact rock. Rocks formed from these fragmentary volcanic materials are known as tuff.

VOLCANIC CONES HAVE SIMILAR CURVATURES

It is entirely of these cindery fragments heaped up with marvellous rapidity round the orifice that the volcano itself is first formed. It may, as in the case of Jorullo in Mexico in 1759, form a cone several hundred feet high in less than a day. Such a cone may have a slope as steep as 30° or 40° , its incline in all cases depending simply on the angle of repose of its materials, the inclination, that is, at which they stop rolling. The great volcanoes of the Andes, which are formed mainly of ash, are very steep. Owing to a general similarity in their materials, volcanic cones in

all parts of the world have very similar curvatures; but older volcanic mountains, in which lava-streams have broken through the cone, secondary cones have arisen, or portions have been blown up, are more irregular in outline and more gradual in inclination.

In size, volcanoes vary from mere mounds a few yards in diameter, such as the *salses* or *mud volcanoes* near the Caspian, to Etna, 10,800 feet high, with a base 30 miles in diameter; Cotopaxi, in the Andes, 18,887 feet high; or Mauna Loa, in the Sandwich Isles, 13,700 feet high, with a base 70 miles in diameter, and two craters, one of which, Kilauea, the largest active crater on our earth, is seven miles in circuit. Larger extinct craters occur in Japan; but all our terrestrial volcanic mountains are dwarfed by those observed on the surface of the moon, which, owing to its smaller size, has cooled more rapidly than our earth. It is, of course, the explosive force from below which keeps the crater clear, as a cup-shaped hollow, truncating the cone; and all stones falling into it would be only thrown out again. It may at the close of an eruption cool down so completely that a lake can form within it, such as Lake Averno, near Naples; or it may long remain a seething sea of lava, such as Kilauea; or the lava may find one or more outlets from it, either by welling over its rim, which it will then generally break down, as in many of the small extinct volcanoes ("puy") of Auvergne, or more usually by bursting through the sides of the cone.

LAVA VARIES VERY MUCH IN LIQUIDITY

It is not generally until the volcano has exhausted its first explosive force that lava begins to issue. Several streams may issue in different directions. Their dimensions are sometimes enormous. Lava varies very much in liquidity and in the rate at which

*Cone of Lava and Ashes
which acts as a stopper and
prevents eruptions under
ordinary pressure.*

WATER LINE

WATER LINE

OCEAN

OCEAN

STEAM

FLUID OR SEMI-FLUID LAVA

Crevices

Crevices

Crevices

THIS DIAGRAM SHOWS HOW VOLCANIC ACTION IS CAUSED

A Study of the above Picture will Show how the Molten Mass in the Mountain's Interior Heat the Water and how the Steam Generated thereby, Following the Line of the Least Resistance, Blow off the Top of the Volcano

it flows. This much depends, however, upon the slope it has to traverse. A lava stream at Vesuvius ran three miles in four minutes, but took three hours to flow the next three miles, while a stream from Mauna Loa ran eighteen miles in two hours. Glowing at first as a white-hot liquid, the lava soon cools at the surface to red and then to black; cinder-like scoriaceous masses form on its surface and in front of the slowly-advancing mass; clouds of steam and other vapor rise from it, and little cones are thrown up from its surface; but many years may elapse before the mass is cooled through. Thus, while the surface is glassy, the interior becomes crystalline.

As to what are the causes of the great convulsions of nature known as the volcano and the earthquake we know very little. Various theories have been advanced, but nothing by any means sure has been discovered, and considerable difference of opinion exists. In truth we know so little concerning the conditions existing in the earth's interior that any views concerning the forces at work there must necessarily be largely conjectural.

Sir Robert S. Ball says, in this connection: "Let us take, for instance, that primary question in terrestrial physics, as to whether the interior of the earth is liquid or solid. If we were to judge merely from the temperatures reasonably believed to exist at a depth of some twenty miles, and if we might overlook the question of pressure, we should certainly say that the earth's interior must be in a fluid state. It seems at least certain that the temperatures to be found at depths of two score miles, and still more at greater depths, must be so high that the most refractory solids, whether metals or minerals, would at once yield if we could subject them to such temperatures in our laboratories. But none of our laboratory experiments can tell us whether, under the pressure of thousands

of tons on the square inch, the application of any heat whatever would be adequate to transform solids into liquids. It may, indeed, be reasonably doubted whether the terms solid and liquid are applicable, in the sense in which we understand them, to the materials forming the interior of the earth.

“A principle, already well known in the arts, is that many, if not all, solids may be made to flow like liquids if only adequate pressure be applied. The making of lead tubes is a well-known practical illustration of this principle, for these tubes are formed simply by forcing solid lead by the hydraulic press through a mould which imparts the desired shape.

“If then a solid can be made to behave like a liquid, even with such pressures as are within our control, how are we to suppose that the solids would behave with such pressures as those to which they are subjected in the interior of the earth? The fact is that the terms solid and liquid, at least as we understand them, appear to have no physical meaning with regard to bodies subjected to these stupendous pressures, and this must be carefully borne in mind when we are discussing the nature of the interior of the earth.”

THE VOLCANOE A SAFETY VALVE

Whatever be the state of affairs in the depths of the earth's crust, we may look upon the volcano as a sort of safety-valve, opening a passage for the pent-up forces to the surface, and thus relieving the earth from the terrible effects of the earthquake, through which these imprisoned powers so often make themselves felt. Without the volcanic vent there might be no safety for man on the earth's unquiet face.

Professor J. C. Russell, of Michigan University, presents the following views concerning the status and action of volcanoes:—

“When reduced to its simplest terms, a volcano may be defined as a tube, or conduit, in the earth’s crust, through which the molten rock is forced to the surface. The conduit penetrates the cool and rigid rocks forming the superficial portion of the earth, and reaches its highly heated interior.

“The length of volcanic conduits can only be conjectured, but, judging from the approximately known rate of increase of heat with depth (on an average one degree Fahrenheit for each sixty feet), and the temperature at which volcanic rocks melt (from 2,300 to 2,700 degrees Fahrenheit, when not under pressure), they must seemingly have a depth of at least twenty miles. There are other factors to be considered, but in general terms it is safe to assume that the conduits of volcanoes are irregular openings, many miles in depth, which furnish passageways for molten rock (lava) from the highly-heated sub-crust portion of the earth to its surface. . . .

ERUPTIONS OF QUIET TYPE

“During eruptions of the quiet type, the lava comes to the surface in a highly liquid condition—that is, it is thoroughly fused, and flows with almost the freedom of water. It spreads widely, even on a nearly level plain, and may form a comparatively thin sheet several hundred square miles in area, as has been observed in Iceland and Hawaii. On the Snake River plains, in Southern Idaho, there are sheets of once molten rock which were poured out in the manner just stated, some four hundred square miles in area and not over seventy-five feet in average thickness. When an eruption of highly liquid lava occurs in a mountainous region, the molten rock may cascade down deep slopes and flow through narrow valleys for fifty miles or more before becoming chilled sufficiently to arrest its progress. Instances are abundant where quiet eruptions have

occurred in the midst of a plain, and built up 'lava cones,' or low mounds, with immensely expanded bases. Illustrations are furnished in Southern Idaho, in which the cones formed are only three hundred or four hundred feet high, but have a breadth at the base of eight or ten miles. In the class of eruption illustrated by these examples, there is an absence of fragmental material, such as explosive volcanoes hurl into the air, and a person may stand within a few yards of a rushing stream of molten rock, or examine closely the opening from which it is being poured out, without danger or serious inconvenience.

"The quiet volcanic eruptions are attended by the escape of steam or gases from the molten rock, but the lava being in a highly liquid state, the steam and gases dissolved in it escape quietly and without explosions. If, however, the molten rock is less completely fluid, or in a viscous condition, the vapors and gases contained in it find difficulty in escaping, and may be retained until, becoming concentrated in large volume, they break their way to the surface, producing violent explosions. Volcanoes in which the lava extruded is viscous, and the escape of steam and gases is retarded until the pent-up energy bursts all bounds, are of the explosive type. One characteristic example is Vesuvius.

"When steam escapes from the summit of a volcanic conduit—which, in plain terms, is a tall vessel filled with intensely hot and more or less viscous liquid—masses of the liquid rock are blown into the air, and on falling build up a rim or crater about the place of discharge. Commonly the lava in the summit portion of a conduit becomes chilled and perhaps hardened, and when a steam explosion occurs this crust is shattered and the fragments hurled into the air and contributed to the building of the walls of the inclosing crater.

“The solid rock blown out by volcanoes consists usually of highly vesicular material which hardened on the surface of the column of lava within a conduit and was shattered by explosions beneath it. These fragments vary in size from dust particles up to masses several feet in diameter, and during violent eruptions are hurled miles high. The larger fragments commonly fall near their place of origin, and usually furnish the principal part of the material of which craters are built, but the gravel-like kernels, lapilli, may be carried laterally several miles if a wind is blowing, while the dust is frequently showered down on thousands of square miles of land and sea. The solid and usually angular fragments manufactured in this manner vary in temperature, and may still be red hot on falling.

“Volcanoes of the explosive type not uncommonly discharge streams of lava, which may flow many miles. In certain instances these outwellings of liquid rock occur after severe earthquakes and violent explosions, and may have all the characteristics of quiet eruptions. There is thus no fundamental difference between the two types into which it is convenient to divide volcanoes.

MOUNTAINS BLOW THEIR HEADS OFF

“In extreme examples of explosive volcanoes, the summit portion of a crater, perhaps several miles in circumference and several thousand feet high, is blown away. Such an occurrence is recorded in the case of the volcano Coseguina, Nicaragua, in 1835. Or, an entire mountain may disappear, being reduced to lapilli and dust and blown into the air, as in the case of Krakatoa, in the Straits of Sunda, in 1883.

“The essential feature of a volcano, as stated above, is a tube or conduit, leading from the highly heated sub-crust portion of the

earth to the crater and through which molten rock is forced upward to the surface. The most marked variations in the process depend on the quantity of molten rock extruded, and on the freedom of escape of the steam and gases contained in the lava.

“The cause of the rise of the molten rock in a volcano is still a matter for discussion. Certain geologists contend that steam is the sole motive power; while others consider that the lava is forced to the surface owing to pressure on the reservoir from which it comes. The view perhaps most favorably entertained at present, in reference to the general nature of volcanic eruptions, is that the rigid outer portion of the earth becomes fractured, owing principally to movements resulting from the shrinking of the cooling inner mass, and that the intensely hot material reached by the fissures, previously solid owing to pressure, becomes liquid when pressure is relieved, and is forced to the surface. As the molten material rises it invades the water-charged rocks near the surface and acquires steam, or the gases resulting from the decomposition of water, and a new force is added which produces the most conspicuous and at times the most terrible phenomena accompanying eruptions.”

The active agency of water is strongly maintained by many geologists, and certainly gains support from the vast clouds of steam given off by volcanoes in eruption and the steady and quiet emission of steam from many in a state of rest. The quantities of water in the liquid state, to which is due the frequent enormous outflows of mud, leads to the same conclusion. Many scientists, indeed, while admitting the agency of water, look upon this as the aqueous material originally pent up within the rocks. For instance Professor Shaler, dean of the Lawrence Scientific School, says:

“Volcanic outbreaks are merely the explosion of steam under high pressure, steam which is bound in rocks buried underneath

the surface of the earth and there subjected to such tremendous heat that when the conditions are right its pent-up energy breaks forth and it shatters its stone prison walls into dust. The process by which the water becomes buried in this manner is a long one. Some contend that it leaks down from the surface of the earth through fissures in the outer crust, but this theory is not generally accepted. The common belief is that water enters the rocks during the crystalization period, and that these rocks through the natural action of rivers and streams become deposited in the bottom of the ocean. Here they lie for many ages, becoming buried deeper and deeper under masses of like sediment, which are constantly being washed down upon them from above. This process is called the blanketing process.

“Each additional layer of sediment, while not raising the level of the sea bottom, buries the first layers just so much the deeper and adds to their temperature just as does the laying of extra blankets on a bed. When the first layer has reached a depth of a few thousand feet the rocks which contain the water of crystalization are subjected to a terrific heat. This heat generates steam, which is held in a state of frightful tension in its rocky prison. Wrinklins in the outer crust of the earth's surface occur, caused by the constant shrinking of the earth itself and by the contraction of the outer surface as it settles on the plastic centers underneath. Fissures are caused by these foldings, and as these fissures reach down into the earth the pressure is removed from the rocks and the compressed steam in them, being released, explodes with tremendous force.”

This view is, very probably, applicable to many cases, and the exceedingly fine dust which so often rises from volcanoes has, doubtless, for one of its causes the sudden and explosive conversion

of water into steam in the interior of ejected lava, thus rending it into innumerable fragments. But that this is the sole mode of action of water in volcanic eruptions is very questionable. It certainly does not agree with the immense volumes at times thrown out, while explosions of such extreme intensity as that of Krakatoa very strongly lead to the conclusion that a great mass of water has made its way through newly opened fissures to the level of molten rock, and exploded into steam with a suddenness which gave it the rending force of dynamite or the other powerful chemical explosives.

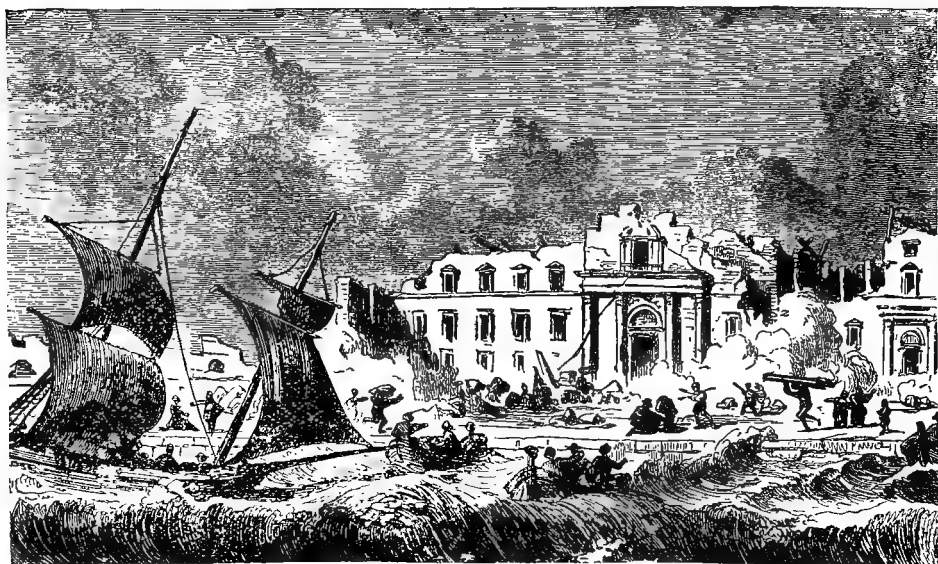
As the earthquake is so intimately associated with the volcano the causes of the latter are in great measure the causes of the former, and the forces at work frequently produce a more or less violent quaking of the earth's surface before they succeed in opening a channel of escape through the mountain's heart. One agency of great potency, and one whose work never ceases, has doubtless much to do with earthquake action. In the description of this we cannot do better than to quote from "The Earth's Beginning" of Sir Robert S. Ball.

CAUSE OF EARTHQUAKES

"As to the immediate cause of earthquakes there is no doubt considerable difference of opinion. But I think it will not be doubted that an earthquake is one of the consequences, though perhaps a remote one, of the gradual loss of internal heat from the earth. As this terrestrial heat is gradually declining, it follows from the law that we have already so often had occasion to use that the bulk of the earth must be shrinking. No doubt the diminution in the earth's diameter due to the loss of heat must be exceedingly small, even in a long period of time. The cause, however, is continually in operation, and, accordingly, the crust of the earth has from time to time to be accommodated to the fact that

the whole globe is lessening. The circumference of our earth at the equator must be gradually declining; a certain length in that circumference is lost each year. We may admit that loss to be a quantity far too small to be measured by any observations as yet obtainable, but, nevertheless, it is productive of phenomena so important that it cannot be overlooked.

“It follows from these considerations that the rocks which form the earth’s crust over the surface of the continents and the



EARTHQUAKE AT MESSINA, 1783.

islands, or beneath the bed of the ocean, must have a lessening acreage year by year. These rocks must therefore submit to compression, either continuously or from time to time, and the necessary yielding of the rocks will in general take place in those regions where the materials of the earth’s crust happen to have comparatively small powers of resistance. The acts of compression will often,

and perhaps generally, not proceed with uniformity, but rather with small successive shifts, and even though the displacements of the rocks in these shifts be actually very small, yet the pressures to which the rocks are subjected are so vast that a very small shift may correspond to a very great terrestrial disturbance.

“Suppose, for instance, that there is a slight shift in the rocks on each side of a crack, or fault, at a depth of ten miles. It must be remembered that the pressure ten miles down would be about thirty-five tons on the square inch. Even a slight displacement of one extensive surface over another, the sides being pressed together with a force of thirty-five tons on the square inch, would be an operation necessarily accompanied by violence greatly exceeding that which we might expect from so small a displacement if the forces concerned had been of more ordinary magnitude. On account of this great multiplication of the intensity of the phenomenon, merely a small rearrangement of the rocks in the crust of the earth, in pursuance of the necessary work of accommodating its volume to the perpetual shrinkage, might produce an excessively violent shock, extending far and wide. The effect of such a shock would be propagated in the form of waves through the globe, just as a violent blow given at one end of a bar of iron by a hammer is propagated through the bar in the form of waves. When the effect of this internal adjustment reaches the earth's surface it will sometimes be great enough to be perceptible in the shaking it gives that surface. The shaking may be so violent that buildings may not be able to withstand it. Such is the phenomenon of an earthquake.

“When our earth is shaken by one of those occasional adjustments of the crust which I have described, the wave that spreads like a pulsation from the centre of agitation extends all over our

globe and is transmitted right through it. At the surface lying immediately over the centre of disturbance there will be a violent shock. In the surrounding country, and often over great distances, the earthquake may also be powerful enough to produce destructive effects. The convulsion may also be manifested over a far larger area of country in a way which makes the shock to be felt, though the damage wrought may not be appreciable. But beyond a limited distance from the centre of the agitation the earthquake will produce no destructive effects upon buildings, and will not even cause vibrations that would be appreciable to ordinary observation.

THE RADIUS OF DISTURBANCE.

“In each locality in which earthquakes are chronic it would seem as if there must be a particularly weak spot in the earth some miles below the surface. A shrinkage of the earth, in the course of the incessant adjustment between the interior and the exterior, will take place by occasional little jumps at this particular centre. The fact that there is this weak spot at which small adjustments are possible may provide, as it were, a safety-valve for other places in the same part of the world. Instead of a general shrinking, the materials would be sufficiently elastic and flexible to allow the shrinking for a very large area to be done at this particular locality. In this way we may explain the fact that immense tracts on the earth are practically free from earthquakes of a serious character, while in the less fortunate regions the earthquakes are more or less perennial.

“Now, suppose an earthquake takes place in Japan, it originates a series of vibrations through our globe. We must here distinguish between the rocks—I might almost say the comparatively pliant rocks—which form the earth's crust, and those which form

the intensely rigid core of the interior of our globe. The vibrations which carry the tidings of the earthquake spread through the rocks on the surface, from the centre of the disturbance, in gradually enlarging circles. We may liken the spread of these vibrations to the ripples in a pool of water which diverge from the spot where a raindrop has fallen. The vibrations transmitted by the rocks on the surface, or on the floor of the ocean, will carry the message all over the earth. As these rocks are flexible, at all events by comparison with the earth's interior, the vibrations will be correspondingly large, and will travel with vigor over land and under sea. In due time they reach, say the Isle of Wight, where they set the pencil of the seismometer at work. But there are different ways round the earth from Japan to the Isle of Wight, the most direct route being across Asia and Europe; the other route across the Pacific, America, and the Atlantic. The vibrations will travel by both routes, and the former is the shorter of the two.

TRANSMISSIONS OF VIBRATIONS

Some brief repetition may not here be amiss as to the products of volcanic action, of which so much has been said in the preceding pages, especially as many of the terms are to some extent technical in character. The most abundant of these substances is steam or water-gas, which, as we have seen, issues in prodigious quantities during every eruption. But with the steam a great number of other volatile materials frequently make their appearance. Though we have named a number of these at the beginning of this chapter, it will not be out of order to repeat them here. The chief among these are the acid gases known as hydrochloric acid, sulphurous acid, sulphuretted hydrogen, carbonic acid, and boracic acid; and with these acid gases there issue hydrogen, nitrogen

ammonia, the volatile metals arsenic, antimony, and mercury, and some other substances. These volatile substances react upon one another, and many new compounds are thus formed. By the action of sulphurous acid and sulphuretted hydrogen on each other, the sulphur so common in volcanic districts is separated and deposited. The hydrochloric acid acts very energetically on the rocks around the vents, uniting with the iron in them to form the yellow ferric-chloride, which often coats the rocks round the vent and is usually mistaken by casual observers for sulphur.

Some of the substances emitted by volcanic vents, such as hydrogen and sulphuretted hydrogen, are inflammable, and when they issue at a high temperature these gases burst into flame the moment that they come into contact with the air. Hence, when volcanic fissures are watched at night, faint lambent flames are frequently seen playing over them, and sometimes these flames are brilliantly colored, through the presence of small quantities of certain metallic oxides. Such volcanic flames, however, are scarcely ever strongly luminous, and the red, glowing light which is observed over volcanic mountains in eruption is due to quite another cause. What is usually taken for flame during a volcanic eruption is simply, as we have before stated, the glowing light of the surface of a mass of red-hot lava reflected from the cloud of vapor and dust in the air, much as the lights of a city are reflected from the water vapor of the atmosphere during a night of fog.

Besides the volatile substances which issue from volcanic vents, mingling with the atmosphere or condensing upon their sides, there are many solid materials ejected, and these may accumulate around the orifices till they build up mountains of vast dimensions, like Etna, Teneriffe, and Chimborazo. Some of these solid materials are evidently fragments of the rock-masses, through which the

volcanic fissure has been rent ; these fragments have been carried upwards by the force of the steam-blast and scattered over the sides of the volcano. But the principal portion of the solid materials ejected from volcanic orifices consists of matter which has been extruded from sources far beneath the surface, in highly-heated and fluid or semi-fluid condition.

It is to these materials that the name of "lavas" is properly applied. Lavas present a general resemblance to the slags and clinkers which are formed in our furnaces and brick-kilns, and consist, like them, of various stony substances which have been more or less perfectly fused. When we come to study the chemical composition and the microscopical structure of lavas, however, we shall find that there are many respects in which they differ entirely from these artificial products, they consisting chiefly of felspar, or of this substance in association with augite or hornblende. In texture they may be stony, glassy, resin-like, vesicular or cellular and light in weight, as in the case of pumice or scoria.

FLOATING PUMICE

The steam and other gases rising through liquid lava are apt to produce bubbles, yielding a surface froth or foam. This froth varies greatly in character according to the nature of the material from which it is formed. In the majority of cases the lavas consist of a mass of crystals floating in a liquid magma, and the distension of such a mass by the escape of steam from its midst gives rise to the formation of the rough cindery-looking material to which the name of "scoria" is applied. But when the lava contains no ready-formed crystals, but consists entirely of a glassy substance in a more or less perfect state of fusion, the liberation of steam gives rise to the formation of the beautiful material known as "pumice."

Pumice consists of a mass of minute glass bubbles ; these bubbles do not usually, however, retain their globular form, but are elongated in one direction through the movement of the mass while it is still in a plastic state. The quantity of this substance ejected is often enormous. We have seen to what a vast extent it was thrown out from the crater of Krakatoa. During the year 1878, masses of floating pumice were reported as existing in the vicinity of the Solomon Isles, and covering the surface of the sea to such extent that it took ships three days to force their way through them. Sometimes this substance accumulates in such quantities along coasts that it is difficult to determine the position of the shore within a mile or two, as we may land and walk about on the great floating raft of pumice. Recent deep-sea soundings, carried on in the *Challenger* and other vessels, have shown that the bottom of the deepest portion of the ocean, far away from the land, is covered with volcanic materials which have been carried through the air or have floated on the surface of the ocean.

Fragments of scoria or pumice may be thrown hundreds or thousands of feet into the atmosphere, those that fall into the crater and are flung up again being gradually reduced in size by friction. Thus it is related by Mr. Poulett Scrope, who watched the Vesuvian eruption of 1822, which lasted for nearly a month, that during the earlier stages of the outburst fragments of enormous size were thrown out of the crater, but by constant re-ejection these were gradually reduced in size, till at last only the most impalpable dust issued from the vent. This dust filled the atmosphere, producing in the city of Naples "a darkness that might be felt." So excessively finely divided was it, that it penetrated into all drawers, boxes, and the most closely fastened receptacles, filling them completely. The fragmentary materials ejected from volcanoes are

often given the name of cinders or ashes. These, however, are terms of convenience only, and do not properly describe the volcanic material.

Sometimes the passages of steam through a mass of molten glass produces large quantities of a material resembling spun glass. Small particles of this glass are carried into the air and leave behind them thin, glassy filaments like a tail. At the volcano of Kilauea in Hawaii, this substance, as previously stated, is abundantly produced, and is known as 'Pele's Hair'—Pele being the name of the goddess of the mountain. Birds' nests are sometimes found composed of this beautiful material. In recent years an artificial substance similar to this Pele's hair has been extensively manufactured by passing jets of steam through the molten slag of iron-furnaces; it resembles cotton-wool, but is made up of fine threads of glass, and is employed for the packing of boilers and other purposes.

The lava itself, as left in huge deposits upon the surface, assumes various forms, some crystalline, others glassy. The latter is usually found in the condition known as obsidian, ordinarily black in color, and containing few or no crystals. It is brittle, and splits into sharp-edged or pointed fragments, which were used by primitive peoples for arrow-heads, knives and other cutting implements. The ancient Mexicans used bits of it for shaving purposes, it having an edge of razor-like sharpness. They also used it as the cutting part of their weapons of war.

CHAPTER XXVII.

The Great Lisbon and Calabrian Earthquakes.

CLOSELY associated with the volcano has always been the earthquake, usually coming as the precursor of its eruptions, often accompanying their paroxysms. It is due to the same causes, whatever these causes may be, the imprisoned forces within the earth acting over great distances during the earthquake, while they are concentrated within some limited space when the volcano begins its work. The earthquake is the most terrible to mankind of all the natural agencies of destruction. While the volcano usually has a greater permanent effect upon surface conditions, it is, as a rule, much less destructive to human life, the earthquake often shaking down cities and burying all their inhabitants in one common grave. Violent earthquakes are also of far more frequent occurrence than destructive volcanic eruptions, many hundreds of them having taken place during the historic period.

While the earthquake is only indirectly connected with the subject of our work, it seems desirable to make some mention of it here, at least so far as relates to those terrible convulsions whose destructiveness has given them special prominence in the history of great disasters. Ancient notable examples are those which threw down the famous Colossus of Rhodes and the Pharos of Alexandria. The city of Antioch was a terrible sufferer from this affliction, it having been devastated some time before the Christian era,

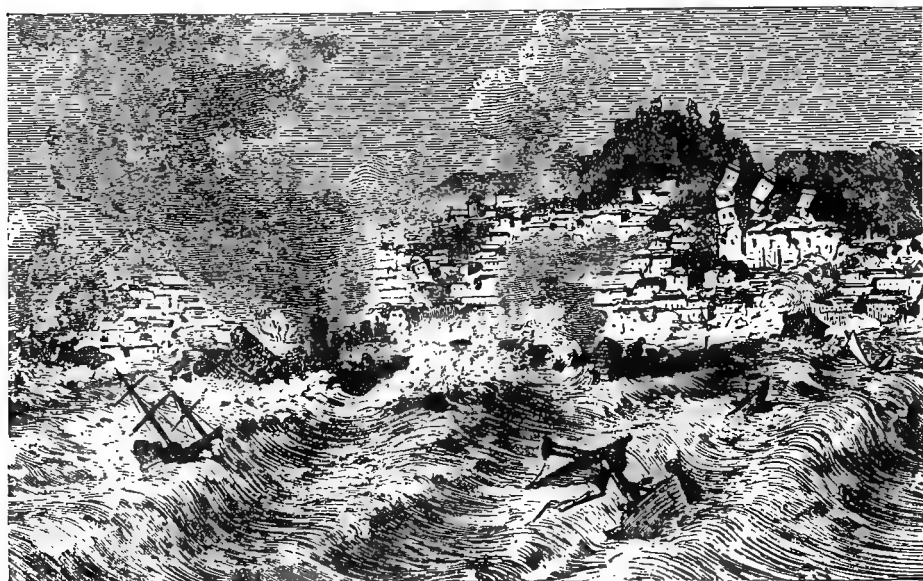
while in the year 859 more than 15,000 of its houses were destroyed. Of countries subject to earthquakes, Japan has been an especial sufferer, in some cases mountains or islands being elevated in association with shocks; in others, great tracts of land being swallowed up by the sea. The number of deaths in some of these instances was enormous.

Numerous thrilling examples of the destructive work of the earthquake might be given, were this our theme. As it has, however, only a collateral connection with our main subject, we shall confine ourselves to a few striking examples of its destructive action. In the record of great earthquakes, one of the most famous is that which in 1755 visited the city of Lisbon, the capital of Portugal, and left that populous place in ruin and dire distress. It may be well to recall the details of this dire event to the memories of our readers.

THE GREAT LISBON EARTHQUAKE

On the night of the 31st of October, 1755, the citizens of the fair city of Lisbon lay down to sleep, in merciful ignorance of what was awaiting them on the morrow. The morning of the 1st of November dawned, and gave no sign of approaching calamity. The sun rose in its brightness, the warmth was genial, the breezes gentle, the sky serene. It was All Saints' Day—a high festival of the Church of Rome. The sacred edifices were thronged with eager crowds, and the ceremonies were in full progress, when the assembled throngs were suddenly startled from their devotions. From the ground beneath came fearful sounds that drowned the peal of the organ and the voices of the choirs. These underground thunders having rolled away, an awful silence ensued. The panic-stricken multitudes were paralyzed with terror. Immediately after the ground began to heave with a long and gentle swell,

producing giddiness and faintness among the people. The tall piles swayed to and fro, like willows in the wind. Shrieks of horror rose from the terrified assembly. Again the earth heaved, and this time with a longer and higher wave. Down came the ponderous arches, the stately columns, the massive walls, the lofty spires, tumbling upon the heads of priests and people. The graven images, the deified wafers, and they who had knelt in adoration



GREAT EARTHQUAKE AT LISBON, NOV. 1, 1753.

before them—the worshipped and the worshippers alike—were in a moment buried under one undistinguishable mass of horrible ruins. Only a few, who were near the doors, escaped to tell the tale.

It fared no better with those who had remained in their dwellings. The terrible earth-wave overthrew the larger number of the private houses in the city, burying their inhabitants under the

crumbling walls. Those who were in the streets more generally escaped, though some there, too, were killed by falling walls.

The sudden overthrow of so many buildings raised vast volumes of fine dust, which filled the atmosphere and obscured the sun, producing a dense gloom. The air was full of doleful sounds—the groans of agony from the wounded and the dying, screams of despair from the horrified survivors, wails of lamentation from the suddenly bereaved, dismal howlings of dogs, and terrified cries of other animals.

In two or three minutes the clouds of dust fell to the ground, and disclosed the scene of desolation which a few seconds had wrought. The ruin, though general, was not universal. A considerable number of houses were left standing—fortunately tenantless—for a third great earth-wave traversed the city, and most of the buildings which had withstood the previous shocks, already severely shaken, were entirely overthrown.

WATER ADDS TO THE DESTRUCTION

The last disaster filled the surviving citizens with the impulse of flight. The more fortunate of them ran in the direction of the open country, and succeeded in saving their lives; but a great multitude rushed down to the harbor, thinking to escape by sea. Here, however, they were met by a new and unexpected peril. The tide, after first retreating for a little, came rolling in with an immense wave, about fifty feet in height, carrying with it ships, barges and boats, and dashing them in dire confusion upon the crowded shore. Overwhelmed by this huge wave, great numbers were, on its retreat, swept into the seething waters and drowned. A vast throng took refuge on a fine new marble quay, but recently completed, which had cost much labor and expense. This the sea-wave

had spared, sweeping harmless by. But, alas ! it was only for a moment. The vast structure itself, with the whole of its living burden, sank instantaneously into an awful chasm which opened underneath. The mole and all who were on it, the boats and barges moored to its sides, all of them filled with people, were in a moment engulfed. Not a single corpse, not a shred of raiment, not a plank nor a splinter floated to the surface, and a hundred fathoms of water covered the spot. To the first great sea-wave several others succeeded, and the bay continued for a long time in a state of tumultuous agitation.

About two hours after the first overthrow of the buildings, a new element of destruction came into play. The fires in the ruined houses kindled the timbers, and a mighty conflagration, urged by a violent wind, soon raged among the ruins, consuming everything combustible, and completing the wreck of the city. This fire, which lasted four days, was not altogether a misfortune. It consumed the thousands of corpses which would otherwise have tainted the air, adding pestilence to the other misfortunes of the survivors. Yet they were threatened with an enemy not less appalling, for famine stared them in the face. Almost everything eatable within the precincts of the city had been consumed. A set of wretches, moreover, who had escaped from the ruins of the prisons, prowled among the rubbish of the houses in search of plunder, so that whatever remained in the shape of provisions fell into their hands and was speedily devoured. They also broke into the houses that remained standing, and rifled them of their contents. It is said that many of those who had been only injured by the ruins, and might have escaped by being extricated, were ruthlessly murdered by those merciless villains.

The total loss of life by this terrible catastrophe is estimated at 60,000 persons, of whom about 40,000 perished at once, and the remainder died afterwards of the injuries and privations they sustained. Twelve hundred were buried in the ruins of the general hospital, eight hundred in those of the civil prison, and several thousands in those of the convents. The loss of property amounted to many millions sterling.

WIDE-SPREAD DESTRUCTION

Although the earth-wave traversed the whole city, the shock was felt more severely in some quarters than in others. All the older part of the town, called the Moorish quarter, was entirely overthrown ; and of the newer part, about seventy of the principal streets were ruined. Some buildings that withstood the shocks were destroyed by fire. The cathedral, eighteen parish churches, almost all the convents, the halls of the inquisition, the royal residence, and several other fine palaces of the nobility and mansions of the wealthy, the custom-houses, the warehouses filled with merchandise, the public granaries filled with corn, and large timber yards, with their stores of lumber, were either overthrown or burned.

The king and court were not in Lisbon at the time of this great disaster, but were living in the neighborhood at the castle of Belem, which escaped injury. The royal family, however, were so alarmed by the shocks, that they passed the following night in carriages out of doors. None of the officers of state were with them at the time. On the following morning the king hastened to the ruined city, to see what could be done toward restoring order, aiding the wounded, and providing food for the hungry.

The royal family and the members of the court exerted themselves to the uttermost, the ladies devoting themselves to the preparation of lint and bandages, and to nursing the wounded, the sick,

and the dying, of whom the numbers were overwhelming. Among the sufferers were men of quality and once opulent citizens, who had been reduced in a moment to absolute penury. The kitchens of the royal palace, which fortunately remained standing, were used for the purpose of preparing food for the starving multitudes. It is said that during the first two or three days a pound of bread was worth an ounce of gold. One of the first measures of the government was to buy up all the corn that could be obtained in the neighborhood of Lisbon, and to sell it again at a moderate price to those who could afford to buy, distributing it gratis to those who had nothing to pay.

For about a month afterward earthquake shocks continued, some of them severe. It was several months before any of the citizens could summon courage to begin rebuilding the city. But by degrees their confidence returned. The earth had relapsed into repose, and they set about the task of rebuilding with so much energy, that in ten years Lisbon again became one of the most beautiful capitals of Europe.

CHARACTERISTICS OF THE LISBON EARTHQUAKE

The most distinguishing peculiarities of this earthquake were the swallowing up of the mole, and the vast extent of the earth's surface over which the shocks were felt. Several of the highest mountains in Portugal were violently shaken, and rent at their summits ; huge masses falling from them into the neighboring valleys. These great fractures gave rise to immense volumes of dust, which at a distance were mistaken for smoke by those who beheld them. Flames were also said to have been observed : but if there were any such, they were probably electrical flashes produced by the sudden rupture of the rocks.

The portion of the earth's surface convulsed by this earthquake is estimated by Humboldt to have been four times greater than the whole extent of Europe. The shocks were felt not only over the Spanish peninsula, but in Morocco and Algeria they were nearly as violent. At a place about twenty-four miles from the city of Morocco, there is said to have occurred a catastrophe much resembling what took place at the Lisbon mole. A great fissure opened in the earth, and an entire village, with all its inhabitants, upwards of 8,000 in number, were precipitated into the gulf, which immediately closed over its prey.

EARTHQUAKES IN CALABRIA

Of the numerous other examples of destructive earthquakes which might be chosen from Old World annals, it will not be amiss to append a brief account of those which took place in Calabria, Italy, in 1783. These, while less wide-spread in their influence, were much longer in duration than the Lisbon cataclysm, since they continued, at intervals, from the 5th of February until the end of the year. The shocks were felt all over Sicily and as far north as Naples, but the area of severe convulsion was comparatively limited, not exceeding five hundred square miles.

The centre of disturbance seems to have been under the town of Oppido in the farther Calabria, and it extended in every direction from that spot to a distance of about twenty-two miles, with such violence as to overthrow every city, town and village lying within that circle. This ruin was accomplished by the first shock on the 5th of February. The second, of equal violence, on the 28th of March, was less destructive, only because little or nothing had been left for it to overthrow.

At Oppido the motion was in the nature of a vertical upheaval of the ground, which was accompanied by the opening of

numerous large chasms, into some of which many houses were engulfed, the chasms closing over them again almost immediately. The town itself was situated on the summit of a hill, flanked by five steep and difficult slopes; it was so completely overthrown by the first shock that scarcely a fragment of wall was left standing. The hill itself was not thrown down, but a fort which commanded the approach to the place was hurled into the gorge below. It was on the flats immediately surrounding the site of the town and on the rising grounds beyond them that the great fissures and chasms were opened. On the slope of one of the hills opposite the town there appeared a vast chasm, in which a large quantity of soil covered with vines and olive-trees was engulfed. This chasm remained open after the shock, and was somewhat in the form of an amphitheatre, 500 feet long and 200 feet in depth.

MOST CALAMITOUS OF THE LANDSLIPS

The most calamitous of the landslips occurred on the sea-coast of the Straits of Messina, near the celebrated rock of Scilla, where huge masses fell from the tall cliffs, overwhelming many villas and gardens. At Gian Greco a continuous line of precipitous rocks, nearly a mile in length, tumbled down. The aged Prince of Scilla, after the first great shock on the 5th of February, persuaded many of his vassals to quit the dangerous shore, and take refuge in the fishing boats—he himself showing the example. That same night, however, while many of the people were asleep in the boats, and others on a flat plain a little above the sea-level, another powerful shock threw down from the neighboring Mount Jaci a great mass, which fell with a dreadful crash, partly into the sea, and partly upon the plain beneath. Immediately the sea rose to a height of twenty feet above the level ground on which the people were

stationed, and rolling over it, swept away the whole multitude. This immense wave then retired, but returned with still greater violence, bringing with it the bodies of the men and animals it had previously swept away, dashing to pieces the whole of the boats, drowning all that were in them, and wafting the fragments far inland. The prince with 1,430 of his people perished by this disaster.

It was on the north-eastern shore of Sicily, however, that the greatest amount of damage was done. The first severe shock, on the 5th of February, overthrew nearly the whole of the beautiful city of Messina, with great loss of life. The shore for a considerable distance along the coast was rent, and the ground along the port, which was before quite level, became afterwards inclined towards the sea, the depth of the water having, at the same time, increased in several parts, through the displacement of portions of the bottom. The quay also subsided about fourteen inches below the level of the sea, and the houses near it were much rent. But it was in the city itself that the most terrible desolation was wrought—a complication of disasters having followed the shock, more especially a fierce conflagration, whose intensity was augmented by the large stores of oil kept in the place.

IMMENSE DESTRUCTION

According to official reports made soon after the events, the destruction caused by the earthquakes of the 5th of February and 28th of March throughout the two Calabrias was immense. About 320 towns and villages were entirely reduced to ruins, and about fifty others seriously damaged. The loss of life was appalling—40,000 having perished by the earthquakes, and 20,000 more having subsequently died from privation and exposure, or from epidemic diseases bred by the stagnant pools and the decaying carcases of men

and animals. The greater number were buried amid the ruins of the houses, while others perished in the fires that were kindled in most of the towns, particularly in Oppido, where the flames were fed by great magazines of oil. Not a few, especially among the peasantry dwelling in the country, were suddenly engulfed in fissures. Many who were only half buried in the ruins, and who might have been saved had there been help at hand, were left to die a lingering death from cold and hunger. Four Augustine monks at Terranuova perished thus miserably. Having taken refuge in a vaulted sacristy, they were entombed in it alive by the masses of rubbish, and lingered for four days, during which their cries for help could be heard, till death put an end to their sufferings.

Of still more thrilling interest was the case of the Marchioness Spastara. Having fainted at the moment of the first great shock, she was lifted by her husband, who, bearing her in his arms, hurried with her to the harbor. Here, on recovering her senses, she observed that her infant boy had been left behind. Taking advantage of a moment when her husband was too much occupied to notice her, she darted off and, running back to the house, which was still standing, she snatched her babe from its cradle. Rushing with him in her arms towards the staircase, she found the stair had fallen—cutting off all further progress in that direction. She fled from room to room, pursued by the falling materials, and at length reached a balcony as her last refuge. Holding up her infant, she implored the few passers-by for help ; but they all, intent on securing their own safety, turned a deaf ear to her cries. Meanwhile the mansion had caught fire, and before long the balcony, with the devoted lady still grasping her darling, was hurled into the devouring flames.

CHAPTER XXVIII.

The Charleston and Other Earthquakes of the United States.

THE twin continents of America have rivalled the record of the Old World in their experience of earthquakes since their discovery in 1492. The first of these made note of was in Venezuela in 1530, but they have been numerous and often disastrous since. Among them was the great shock at Lima in 1746, by which 18,000 were killed, and those at Guatemala in 1773, with 33,000, and at Riobamba in 1797, with 41,000 victims. It will, however, doubtless prove of more interest to our readers if we pass over these ruinous disasters and confine ourselves to the less destructive earthquakes which have taken place within our own country.

The United States, large a section of North America as it occupies, is fortunate in being in a great measure destitute of volcanic phenomena, while destructive earthquakes have been very rare in its history. This, it is true, does not apply to the United States as it is, but as it was. It has annexed the volcano and the earthquake with its new accessions of territory. Alaska has its volcanoes, the Philippines are subject to both forms of convulsion, and in Hawaii we possess the most spectacular volcano of the earth, while the earthquake is its common attendant. But in the older United States the volcano contents itself with an occasional puff of smoke, and eruptive phenomena are confined to the minor form of the geyser.

We are by no means so free from the earthquake. Slight movements of the earth's surface are much more common than many of us imagine, and in the history of our land there have been two or three earth shocks of considerable violence. The most destructive was that of Charleston in 1886, though the 1812 convulsion in the Mississippi Valley might have proved a much greater calamity but for the fact that civilized man had not then largely invaded its centre of action.

As regards the number of earth movements in this country, we are told that in New England alone 231 were recorded in two hundred and fifty years, while doubtless many slighter ones were left unrecorded. Taking the whole United States, there were 364 recorded in the twelve years from 1872 to 1883, and in 1885 fifty-nine were recorded, more than two-thirds of them being on the Pacific slope. Most of these, however, were very slight, some of them barely perceptible.

Confining ourselves to the earthquakes important in their effects, we may first speak of the shocks which took place in New England in 1755, in the year and month of the great earthquake at Lisbon. On the 18th of November of that year, while the shocks at Lisbon still continued, New England was violently shaken, loud underground explosive noises accompanying the shocks. In the harbors along the Atlantic coast there was much agitation of the waters and many dead fish were thrown up on the shores. The shock, indeed, was felt far from the coast, by the crew of a ship more than two hundred miles out at sea from Cape Ann, Massachusetts.

This event, however, was of minor importance, being much inferior to that of 1812, in which year California and the Mississippi Valley alike were affected by violent movements of the earth's

crust. The California convulsions took place in the spring and summer of that year, extending from the beginning of May until September. Throughout May the southern portion of that region was violently agitated, the shocks being so frequent and severe that people abandoned their houses and slept on the open ground. The most destructive shocks came in September, when two Mission houses were destroyed and many of their inmates killed. At Santa Barbara a tidal wave invaded the coast and flowed some distance into the interior.

It may be said here that California has proved more subject to severe shocks than any other section of our country. In 1865 sharp tremors shook the whole region about the Bay of San Francisco, many buildings being thrown down. Hardly any of brick or stone escaped injury, though few lives were lost. In 1872 a disturbance was felt farther west, the whole range of the Sierra Nevada mountains being violently shaken and the earth tremblings extending into the State of Nevada. The centre of activity was along the crest of the range, and immense quantities of rock were thrown down from the mountain pinnacles. A tremendous fissure opened along the eastern base of the mountain range for forty miles, the land to the west of the opening rising and that to the east sinking several feet. One small settlement, that of Lone Pine, in Owen's Valley, on the east base of the mountains, was completely demolished, from twenty to thirty lives being lost. Luckily, the region affected had very few inhabitants, or the calamity might have been great.

The earthquakes of 1812 in the Mississippi Valley began in December, 1811, and continued at intervals until 1813. As a rule they were more distinguished by frequency than violence, though on several occasions they were severe and had marked effects.

They extended through the valleys of the Mississippi, Arkansas and Ohio, and their long continuance was remarkable in view of the territory affected being far from any volcanic region.

The surface of the valley of the Mississippi was a good deal altered by these convulsions—several new lakes being formed, while others were drained. Several new islands were also raised in the river, and during one of the shocks the ground a little below New Madrid was for a short time lifted so high as to stop the current of the Mississippi, and cause it to flow backward. The ground on which this town is built, and the bank of the river for fifteen miles above it, subsided permanently about eight feet, and the cemetery of the town fell into the river. In the neighboring forest the trees were thrown into inclined positions in every direction, and many of their trunks and branches were broken. It is affirmed that in some places the ground swelled into great waves, which burst at their summits and poured forth jets of water, along with sand and pieces of coal, which were tossed as high as the tops of trees. On the subsidence of these waves, there were left several hundreds of hollow depressions from ten to thirty yards in diameter, and about twenty feet in depth, which remained visible for many years afterward. Some of the shocks were vertical, and others horizontal, the latter being the most mischievous. These earthquakes resulted in the general subsidence of a large tract of country, between seventy and eighty miles in length from north to south, and about thirty miles in breadth from east to west. Lakes now mark many of the localities affected by the earthquake movements. It is only to the fact that this country was then very thinly settled that a great loss of life was avoided.

New Madrid, Missouri, was a central point of this earthquake, the shocks there being repeated with great frequency for several

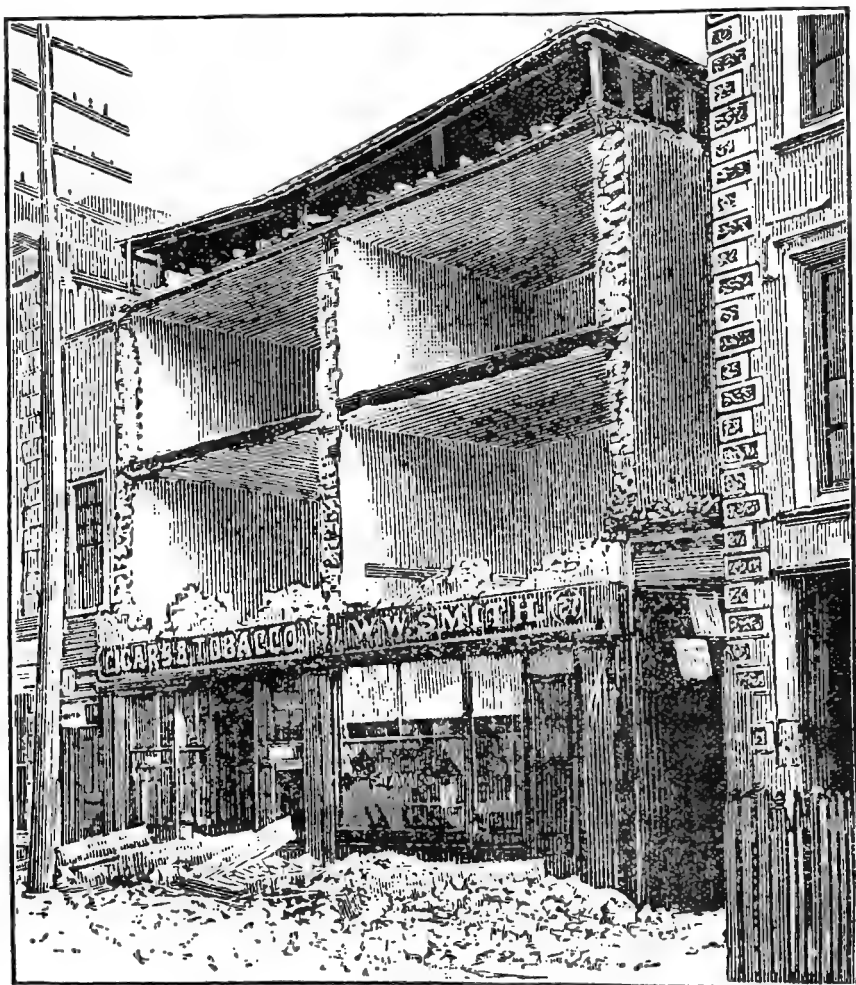
months. The disturbance of the earth, however, was not confined to the United States, but affected nearly half of the western hemisphere, ending in the upheaval of Sabrina in the Azores, already described. The destruction of Caracas, Venezuela, with many thousands of its inhabitants, and the eruption of La Soufriere volcano of St. Vincent Island were incidents of this convulsion. Dr. J. W. Foster tells us that on the night of the disaster at Caracas the earthquake grew intense at New Madrid, fissures being opened six hundred feet long by twenty broad, from which water and sand were flung to the height of forty feet.

The most destructive of earthquakes in the United States was that which visited Charleston, South Carolina, in 1886, the injury caused by it being largely due to the fact that it passed through a populous city. As it occurred after many of the people had retired, the confusion and terror due to it were greatly augmented, people fleeing in panic fear from the tumbling and cracking houses to seek refuge in the widest streets and open spaces.

South Carolina had been affected by the wide-spread earthquakes of 1812. These in some cases altered the level of the land, as is related in Lyell's "Principles of Geology." But the effect then was much less than in 1886. Several slight tremors occurred in the early summer of that year, but did not excite much attention. More distinct shocks were felt on August 27th and 28th, but the climax was deferred till the evening of August 31st. The atmosphere that afternoon had been unusually sultry and quiet, the breeze from the ocean, which generally accompanies the rising tide, was almost entirely absent, and the setting sun caused a little glow in the sky.

"As the hour of 9.50 was reached," we are told, "there was suddenly heard a rushing, roaring sound, compared by some to a

train of cars at no great distance, by others to a clatter produced by two or more omnibuses moving at a rapid rate over a paved



RUINOUS EFFECT OF THE CHARLESTON EARTHQUAKE.

street, by others again, to an escape of steam from a boiler. It was followed immediately by a thumping and beating of the earth beneath the houses, which rocked and swayed to and fro. Furniture

was violently moved and dashed to the floor; pictures were swung from the walls, and in some cases turned with their backs to the front, and every movable thing was thrown into extraordinary convulsions. The greatest intensity of the shock is considered to have been during the first half, and it was probably then, during the period of its greatest sway, that so many chimneys were broken off at the junction of the roof. The duration of this severe shock is thought to have been from thirty-five to forty seconds. The impression produced on many was that it could be subdivided into three distinct movements, while others were of the opinion that it was one continuous movement, or succession of waves, with the greatest intensity, as already stated, during the first half of its duration."

Twenty-seven persons were killed outright, and more than that number died soon after of their hurts or from exposure; many others were less seriously injured. Among the buildings, the havoc, though much less disastrous than has been recorded in some other earthquakes in either hemisphere, was very great. "There was not a building in the city which had escaped serious injury. The extent of the damage varied greatly, ranging from total demolition down to the loss of chimney tops and the dislodgment of more or less plastering. The number of buildings which were completely demolished and levelled to the ground was not great; but there were several hundreds which lost a large portion of their walls. There were very many also which remained standing, but so badly shattered that public safety required that they should be pulled down altogether. There was not, so far as at present is known, a brick or stone building which was not more or less cracked, and in most of them the cracks were a permanent disfigurement and a source of danger and inconvenience." In some

places the railway track was curiously distorted. "It was often displaced laterally, and sometimes alternately depressed and elevated. Occasionally several lateral flexures of double curvature and of great amount were exhibited. Many hundred yards of track had been shoved bodily to the south eastward."

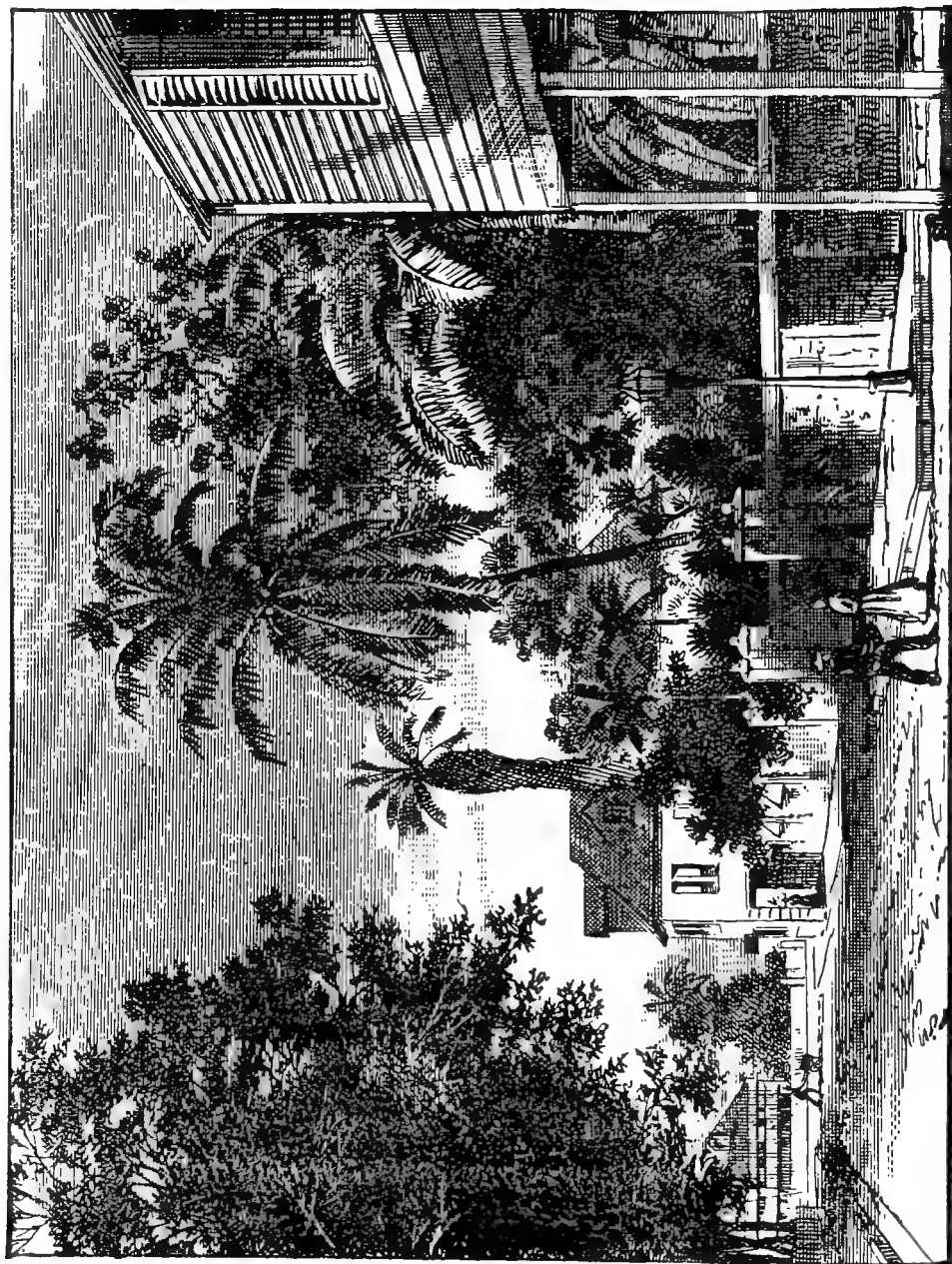
The ground was fissured at some places in the city to a depth of many feet, and numerous "craterlets" were formed, from which sand was ejected in considerable quantities. These are not uncommon phenomena, and were due, no doubt, to the squirting of water out of saturated sandy layers not far below the surface; these being squeezed between two less pervious beds in the passage of the earthquake wave. The ejected material in the Charleston earthquake was ordinary sand, such as might exist in many districts which had been quite undisturbed by any concussions of the earth.

Captain Dutton made a careful study of the observations collected by himself and others concerning this earthquake, and came to the conclusion that the Charleston wave traveled with unusual speed, for its mean velocity was about 17,000 feet a second. The focus of the disturbance was also ascertained. Apparently it was a double one, the two centres being about thirteen miles apart, and the line joining them running nearly the same distance to the west of Charleston. The approximate depth of the principal focus is given as twelve miles, with a possible error of less than two miles; that of the minor one as roughly eight miles.

The Charleston earthquake was felt as a tremor of more or less force through a wide area, embracing 900,000 square miles, and affecting nearly the whole country east of the Mississippi. It is said that the yield of the Pennsylvania natural gas wells decreased, and that a geyser in the Yellowstone valley burst into action after

four years of rest. The movement of the earth-wave was in general north and south, deflected to east and west, and the snake-like fashion in which rails on the railroad were bent indicated both a vertical and a lateral force.

This earthquake has been attributed to various causes, but geological experts think that it was due to a slip in the crust along the Appalachian Mountain chain. There is a line of weakness along the eastern slope of this chain, characterized by fissures and faults, and it was thought that a strain had been gradually brought to bear upon this through the removal of earth from the land by rains and rivers and its deposition in thick strata on the seabottom. It is supposed that this variation in weight in time caused a yielding of the strata and a slip seaward of the great coastal plain. Professor Mendenhall, however, thinks it was due to a readjustment of the earth's crust to its gradually sinking nucleus. In fact, we know so little of the dynamics of the earth that all such theories are of very slight value, and we may rest under the assurance that no one knows to what internal disturbance the Charleston earthquake was due.



A RESIDENCE ON ISLAND OF MARTINIQUE.

CHAPTER XXIX.

The Verdict of Science on Mont Pelee and La Soufriere.

IT seems only proper, from the vital importance of the recent disaster in Martinique and the intense interest which it has aroused in all civilized lands, to give Mont Pelee and its remarkable phenomena the last word in our work. We have described fully the fatal events of May 8, giving numerous descriptions by eye-witnesses of the terrible disaster. The scientists of our country also had much to say concerning it, but in view of the fact that they were giving book knowledge only, we have not repeated their statements. Yet the news of the explosion were quickly followed by visits of geologists to the scene, to investigate the mountain and its doings with their trained senses and educated powers of observation. It is proposed to devote the present chapter to an account of their work.

The second great explosion of Mont Pelee, that of May 20, has already been described in connection with the visit of the *Potomac* and the perilous work of recovery of the body of Consul Prentiss. This explosion much surpassed in violence that which destroyed St. Pierre. For many hours the detonations were so heavy that it seemed as if the island would be shaken to its foundation. Down upon the ruins of St. Pierre fell great boulders, which battered what was left of the unfortunate city out of all semblance of its former self. Ashes fell in torrents, and the ruins made by the

former explosion were covered until the site of the city resembled a great gray plain.

For six hours Fort de France also was literally bombarded. Stones, many of them incandescent, rained upon the city from the clouds. Houses were destroyed and fires were started in many quarters. With the stones fell hot mud and ashes. The air was so filled with volcanic dust that it was barely possible to breathe. It seemed as if suffocation must be the fate of all who could not be taken on board the ships in the harbor, and terror reigned supreme. Clustered about the ships were small boats filled with natives, who begged to be taken up. Hundreds, finding it impossible to obtain boats to take them to the ships, swam out, risking their lives in the water to avoid the danger which filled them with more terrible dread. Great numbers of people had already left the island, and on that day of panic it might have been wholly deserted had this been possible.

On the 21st the *Potomac* returned to the scene of disaster, on this occasion taking thither a number of the scientists who had reached Fort de France. In this party of experts were Professor F. A. Jagger, of Harvard; Professor Israel C. Russell, of the University of Michigan; Professor Robert T. Hill, of the United States Geological Survey; Dr. E. O. Hovey, of the American Museum of Natural History, and Captain C. E. Borchgrevink, the famous Antarctic explorer and geologist. All these were told that they would be allowed to land only on condition that they immediately obeyed the signal which would be given by the *Potomac's* whistle should the mountain show signs of danger.

Leaving the landing place, the party plunged into the ruins, and, separating into groups, wandered in and through the streets of the dead. Never was there a scene of devastation more complete.

That there had been a wind of the fury of a terrible cyclone was shown by the bent and twisted rods of iron and the huge black trunks of trees, several feet in diameter, which had been torn from the earth and hurled many feet from where they grew. That there had been heat of awful intensity was proved by the great stumps of the giant tree trunks which had been completely consumed. Gone was every vestige of the great thick curtain of foliage that covered the bluffs back of the city, not even a stick being left on the gray face of the cliffs. The splendid foliage that made the botanical garden the pride of the city had been swept away like leaves from the full-blown rose, leaving absolutely nothing but bare, parched earth and crumbling rock. The fountains were broken and scattered and the lakes were dried up.

Against the north side of every wall were banked gray ashes as snow is banked against the houses during a northern snow storm. Not a single roof was left standing anywhere. Inside the dust-covered walls of the buildings were piled high the debris of the upper portions of the same walls. There was a monotony of wreck and ruin, varied in some streets only by the discovery of bodies, burned and unrecognizable, here and there in the houses and courtyards.

As the walls had been thrown down in an exact direction toward the southwest the debris rendered it difficult to distinguish the streets, and it was impossible, even for one who had known the city in life, to point out other than in the most general way the significant features of its skeleton.

At the very southern end of the city, in the suburb called Anse, in which had lived many of the wealthy and which had once been a perfect bower of trees and ferns and flowers, there was simply a waste of dust, and low, crumbling walls. No living thing; no

sound; a ghastly expanse of gray. There had been spared portions of many dwellings, in which could be found the bodies of numerous persons. But masters and servants alike had shared the common lot.

The mansion of a retired planter named Leon Marie, in this suburb, was visited, the body of a man lying face downward being found at the gateway. In what had evidently been the servants' quarters there had been less destruction than in any other house in the entire city. The bodies found here nearly all lay on their faces. Near the threshold of one room lay the body of a 14-year-old child, clasping the hand of an old man. At the opposite side of the room was the body of a colored woman, evidently a servant. A bowl of gruel lay before her, and a pipe lying near had evidently dropped from her mouth. Near by were the bodies of two children, one a girl of five years and one of three. They were lying in natural attitudes and were little burned. It would seem as if the little party had just finished the morning meal. At the entrance to another room were found the bodies of three young women, but in this room the fire had been less merciful, and the bodies were utterly unrecognizable.

THE RUE VICTOR HUGO.

Down the Rue Victor Hugo, at once the Broadway and the Fifth Avenue of the city, the awful force had swept with unobstructed fury. They found it but a seared and blighted gulley between higher banks of crumbling dust and ashes like a rift in a pile of furnace slag. Here and there in the debris were charred sections of bones, showing at the surface of the ash-heap. The great square on which once stood the Hotel de Ville, the house of the city government, was but a gray waste on which the dust had

drifted into hummocks covering pieces of crumbled stone or against the giant black trunks—half charcoal now—of what had been giants of the tropical jungle guarding the city.

Fountains, terraces, balustrades had been transformed into dust and ashes. Inside the low, fallen walls of the City Hall, where the laws of man had been executed, the enforcement of the inscrutable laws of nature had left but dust. In some of the cross streets in this central section of the city the all-consuming breath of the fiery mouth to the northward, leveling a thousand walls within a brief interval of time, had not done its work quite so thoroughly, and in some of the houses about this great central square a little useless rubbish could be distinguished from the all-pervading ashes.

On one fire-swept square was witnessed the first grateful sight visible in that depressing walk. Where less than twenty-four hours before the very breath of hell itself had hissed over the gray surface of the ground and swept the ashes clear, peeped timidly forth from the earth a tender shoot of green. It looked like grass, but whatever its name it was the first sign of life in this seared inferno. It was the first courier of that tropical sea of verdure that was destined at last to sweep irresistibly over the barren waste and to heal a scar on nature's face even as long and deep as this.

And, stranger still, on one of the bleak terraces ants had already made their appearance from the depth below, and were busy making explorations on their own account—the advance guard of that mighty insect life destined again to swarm over this fallen city when once the siege was raised.

The work of exploration ended suddenly when the *Potomac* in the harbor blew her warning whistle—blew it again and again! Looking toward the base of the mountain, the explorers could see the

hideous elevation almost covered with leaping jets of steam. Creeping down upon the northern end of the ruins and showing around the edge of the bluff was a great cloud of white vapor. Almost as far as the eye could reach northward along the shore line the white lacework of steam was floating higher and higher. The air seemed to grow suddenly more stifling and depressing. The sun became hidden somewhere, and there was a flash of lightning.

Over terrace and wall and stone heap white-clad explorers sought the shore by leaps and bounds, and, gaining the boats, pulled for the *Potomac*. The vessel had slipped her moorings and, was slowly steaming forward. She got her boats aboard, and moving slowly northward, there was visible a magnificent view of the terrifying and fascinating panorama.

Around its top the dark mountain, 4,450 feet above them, was curtained in a coat of black, out of the apex of which rolled a mass of white like an enormous cotton bowl. On the south side, just below the cloud curtain, there yawned an awful chasm which appeared to be a second crater, though it was not active. Leading down from the active crater hidden above and directly facing the sea was a tremendous cleft hundreds of feet deep, down which could be traced a great volume of steam. On the black, precipitous sides of the mountain, which looked like an enormous heap of cinders, there were at intervals depressions hundreds of feet in width and length, as if some Titanic hand had reached out and clawed great masses from the mountain side. Boiling mud was flowing everywhere over an area probably twenty-five square miles in extent.

Suddenly the curtain of cloud above was lifted and Pelee showed her teeth. The crater was almost circular slightly below the top of the peak and on the westward side. The pit appeared to be about a half a mile in diameter, and on the side toward the

sea the rim was broken in the cleft spoken of above. They could look through this cleft and see one side of the crater's interior. There was a mass of jet-black substance like bitumen, from which were hissing geysers of white and black vapor. It was as if the tarry packing about the axle of the world had been exposed, smoking hot.

Professor Hovey, one of the scientific party in the *Potomac*, gave the following estimate of what he saw. After stating that the column of steam and dust on May 20 rose to a height of seven miles, he continues : "Vast columns of dust and stones up to three ounces in weight were rained on the city of Fort de France, and additional havoc was wrought in the ruins of St. Pierre. A thick stream of mud buried another third of the city, stopping only at the seashore. An examination of the stones which fell at Fort de France showed them to be a variety of lava called hornblende and andesite. They were bits of the old lava forming that part of the cone. There was no pumice shown to me, but the dust and lapilli all seemed to be composed of comminuted old rock.

"In general the north and south walls of the buildings at St. Pierre were better preserved than the east and west walls, the latter usually being razed to the ground. The trees, stanchions, monuments and formerly erect objects were bent over or had been knocked down toward the south. These facts show that the city was destroyed by a tornado-like blast from the mountain. It is evident that the onrush of suffocating gas which wrecked the buildings asphyxiated the people, fire then completing the ruin.

"This comes nearer to being a sheet of flame than anything heretofore reported from any volcano. Mud was formed in two ways, by the mixture in the atmosphere of dust and condensed steam, and by cloudbursts on the upper dust-covered slopes of the cone,

washing down vast quantities of fine, light dust. No flow of lava had apparently attended the eruption, the purely explosive action apparently bringing no molten material to the surface.

NEW FEATURES IN THE ERUPTION

“Except as measured by the loss of life and destruction of property, the eruption cannot yet rank with the great explosions of history. Mont Pelee, however, may not be done yet. The great emission of suffocating gas and the typical cloudburst, with the resulting streams of mud, are among the new features which Pelee has added to the scientific knowledge of volcanoes.”

This visit of scientists to St. Pierre may be fitly supplemented by an account of the efforts of others to reach the source of the disaster, by ascending the perilous flanks of Mont Pelee. The first man to venture on the fire-breathing mountain was M. Clerc, a planter of Martinique, and the last, as already stated, to escape from St. Pierre before the eruption. He, with a sugar-works' engineer, ascended to a height of 1,251 metres. Here, he says :

“We felt a number of electric commotions and our shoes were damaged by the heat. The pond which was situated near Morne la Croix is completely dried up. The iron cross which stood at the foot of the mountain has been melted. Only the base of the masonry, on which the cross stood, and the lower part of the foot of the cross can be seen.

“The rims of the crater have very much changed in appearance, and the heat where we stood was intense and the whole aspect of the mountain was terrifying. Stones fell around us and we picked up large pieces of sulphur, which, however, we were unable to retain. The whole spot was charged with electricity, which became so violent that we were obliged to retreat.

"Our descent from the mountain was more difficult than our ascent. A blinding rain of ashes fell upon us, and the engineer was nearly killed by a large stone which fell near him. We succeeded in reaching Basse Pointe, on our return, after having been four hours on the mountain under the most dangerous circumstances."

Among the first of the scientists to attempt the perilous ascent was Professor Robert T. Hill, government geologist of the United States, and head of the expedition sent by the National Geographical Society. His account of his experience is the following :

"My attempt to examine the crater of Mont Pelee has been futile. I succeeded, however, in getting close to Morne Rouge. At 7 o'clock Monday night, I witnessed, from a point near the ruins of St. Pierre, a frightful explosion from Mont Pelee and noted the accompanying phenomena. While these eruptions continue no sane man should attempt to ascend to the crater of the volcano.

PROFESSOR HILL'S EXPERIENCE

"Following the salvos of detonations from the mountain, gigantic mushroom-shaped columns of smoke and cinders ascended into the clear starlit sky and then spread, in a vast black sheet, to the south and directly over my head. Through this sheet, which extended a distance of ten miles from the crater, vivid and awful lightning-like bolts flashed with alarming frequency. They followed distinct paths of ignition, but were different from lightning in that the bolts were horizontal and not perpendicular.

"This is indisputable evidence of the explosive oxidation of the hydrogen and other gases after they left the crater. It is a most important observation and explains in part the awful catastrophe. The phenomenon is entirely new in volcanic history.

"I took many photographs, but do not hesitate to acknowledge that I was terrified. But I was not the only person so frightened.

Two newspaper correspondents who were close to Morne Rouge some hours before me became scared, ran three miles down the mountain, and hastened to Fort de France.

“Nearly all the phenomena of these volcanic outbreaks are new to science, and many of them have not yet been explained. The volcano is still intensely active and I cannot make any predictions as to what it will do.”

In addition to this vivid description of his actual study of the volcanic phenomena, Prof. Hill's account of his dangerous journey is equally interesting.

He left Fort de France at 1 o'clock Monday afternoon. He was accompanied by a Mr. Cavanaugh, an army officer from Trinidad, and a boy named Joe, who was to act as interpreter. The party set out on horseback and took the direct north road for Morne Rouge. Between the hamlets of Deux Choux and Fonds St. Denis the party entered the outer edge of the zone of ashes. Except for occasional patches all the country to this point was green and smiling.

Upon reaching the Raibaud plantation, one mile southwest of St. Pierre, the explorers met the clear line of demarcation of the zone of flame and destruction, although not of annihilation. Monday night was spent in a deserted house at Fonds St. Denis, from which Prof. Hill witnessed and studied the volcanic eruption of that night. At this point the horses of the party became exhausted.

Early the next morning Prof. Hill pushed on to Mont Par-nasse, where several people were killed in the eruption of May 8. He encountered no human beings, but he met a number of abandoned cattle, which tried to follow him. From Mount Par-nasse the explorer proceeded to Morne Rouge, where he succeeded

in getting a number of important photographs. He found that a close approach to Mont Pelee was impossible, and, as his actual position was dangerous, he started back in a southerly direction.

At Champs Flore, Prof. Hill's horse gave out completely, and he secured the services of native guides, who led him by wild mountain paths back to Fonds St. Denis and Deux Choux.

Tuesday night was spent at the latter place. From this point Prof. Hill sent a messenger into Fort de France with a request that a carriage be sent for him. Wednesday morning the professor left Deux Choux and walked to within sixteen miles of Fort de France, where he borrowed an old horse from a negro and continued his journey mounted. The carriage met him six miles from Fort de France and brought him back to town, where he arrived at 11 o'clock the next morning.

George J. Kavanaugh, a newspaper correspondent who tried to reach the source of peril, set out on his expedition on May 26. Leaving Fort de France, he reached the north end of the island, where he sought in vain to find a guide. His not finding one, he tells us, saved his life.

"I slept that night at Fonds St. Denis, and when the terrific explosion occurred about eight o'clock I was thankful enough that I was not on the mountain side. I saw the eruption, and without attempting to describe it I will say that it was the most wonderful display that was ever placed before human eyes.

"Mont Pelee stormed and thundered and sent great sheets of fire high into the heavens. Sulphur fumes filled the air and made respiration difficult. Below us the sea was lashed into a terrible fury. Great waves rolled in upon the island, although there had been almost a dead calm of the atmosphere during the day.

"This display did not long continue. Mont Pelee became less active before morning. Deep within its bowels there was a struggle, but the only evidences we at Fonds St. Denis had were the low rumbles, that seldom ceased.

"After breakfast I went on to Morne Rouge. It had been a night of terror in that village. Expecting to share the fate that had befallen St. Pierre, the inhabitants had remained in the church praying for protection. From Morne Rouge I continued my effort to reach the crater of Mont Pelee. I explored the base of the volcano and went at least half-way to the summit.

"In the valleys were many dead. I entered houses and found entire families destroyed. Most of them had died from suffocation. Men, women and children had fallen while fleeing from the danger which threatened them. Southeast of Pelee the valleys were almost entirely filled with ashes.

"The eastern slope of the volcano was absolutely barren. It was not difficult to ascend, and I went up until my way was barred by a deep fissure. I followed this fissure, which soon branched and deepened. It led around the southern side of the mountain, and opened, as I could see, into the crater, from which at that time nothing was coming except two columns of smoke, one jet black, the other yellow. Later in the day the sides of the crater caved in, and immediately great clouds of ashes were ejected.

"As the volcano did not show signs of activity other than those I have described I was in little danger during the day, but as I remained too late it was with difficulty that I made my way back to Morne Rouge. On Wednesday I explored the valley south of Pelee."

Explorers of greater daring, or at least of superior success, were to follow. First of these was George Kennan, a famous

Siberian explorer of years ago. He started from Fort de France with a land party, reaching the extreme northern end of the island in time to witness the eruption of Monday, May 26. On the morning of the 28th an outburst of very black smoke shot upward from the crater and much fear was entertained for the safety of Kennan and his party. But about 10 o'clock that morning M. Clerc, who had been with him, reached Fort de France and announced that the party were safe in a plantation at the north end of the island.

WHAT M. CLERC WITNESSED

Mr. Clerc had a very interesting story to tell. He said: "We got around the mountain and reached the new crater, not far from Ajoupa Bouillon. We discovered that it had broken out at the very head of the river Falaise and about 200 yards from the high road. Our party rode directly to the edge of the crater, as it was then quiescent. We saw that a great slice of the mountain had fallen, leaving exposed a perpendicular cliff. In this cliff were five huge tunnels, which were not smoking. The crater is a great, sloping oval depression, from which smoke issues, as it does from the great crater, with the exception that here and there were few ashes in the smoke. The river Falaise is boiling hot and so muddy that one quart of water weighed four pounds. Volcanic stones of the nature of pumice float in the water.

Mr. Kennan witnessed the explosion of Monday night and was much interested in the phenomena. The explosion was accompanied at intervals by bright light which lasted for half an hour at a time. This light was steady and illuminated the entire mountain top. Prof. Hill says he did not see the light. I left Mr. Kennan and his party in good health and in safety. They seemed to be in no hurry to come back to Fort de France."

On May 24 the steamer *Fontabelle* reached Fort de France, her passengers including several scientists, one of them being Professor Angelo Heilprin, President of the Geographical Society of Philadelphia and a representative in this journey of the National Geographical Society of America. We speak of him here in particular, in recognition of his daring and success in being the first to reach the edge of the crater of Mont Pelee. He left Fort de France on Thursday, May 29, at the head of a party organized by himself and Consul Ayme. Friday was spent in studying the newly formed craters on the north flank of the mountain. Saturday morning Professor Heilprin determined to attempt the ascent to the top of the crater, and, with this purpose in view, he set out at 5 o'clock in company with Mr. Leadbetter and three negro guides.

The party proceeded on mules to an altitude of 700 metres, the ancient line of vegetation. From this point Heilprin continued on foot, leaving the mule that had carried him up the steep hog-back to the tree line. Upon reaching the lip of the old crater at Lake Palmiste, a fierce thunderstorm prevented further progress, and after remaining for some time in that perilous position, he was obliged to descend, after an attempt of extreme danger.

His journey down the side of the mountain was fully as perilous as the ascent. Mont Pelee seemed to resent the intrusion of a puny human being into her most awful precincts, and belched out huge volumes of steam, ashes and boiling hot mud. The daring adventurer was nearly suffocated by the choking vapors he had breathed, and was thickly coated with volcanic mud.

The Professor made the important discovery that the crater at the head of the river Fallaise has synchronous eruptions with the crater at the summit of the volcano, and that it ejects precisely the same matter at such times. The river Fallaise

crater and the crater at the summit showed during Professor Heilprin's visit a new phenomenon. Mud was thrown up in high columns. Heretofore the mud had bubbled or boiled out and flowed downward in huge streams. In the course of one eruption of the river Fallaise crater an enormous mass of intensely hot mud was ejected. This flow reached the rum distillery on the Vive plantation and extinguished all the fires there.

On the following day, Sunday, May 25, Professor Heilprin again ascended the mountain, this time in company with George Kennan and one of his associates, Mr. Varian. No accident occurred in the dangerous enterprise, though the explorers were exposed to great hardships and many dangers. Mr. Kennan's account of the daring venture is as follows. It begins with a well-deserved eulogy of his comrade :

"I must preface all I have to say by paying the highest possible tribute to Professor Heilprin. He is modest and brave, a superb mountaineer, and the nerviest and pluckiest man I ever knew. Professor Heilprin's first ascent of Mont Pelee last Saturday with Mr. Leadbetter was a most awful experience, yet he started a second time undaunted.

"Five of us started for the crater of the volcano last Sunday, and three of us reached our objective. We crossed Lake Palmiste, which is now dry and full of boulders and huge, ragged rocks of trachyte, rhyolite and andesite. We then climbed on up and reached the edge of the crater. We found it to be a huge chasm, or crevasse, with perpendicular walls.

"We could not see down into the crater more than one hundred and fifty feet ; it was like looking into a white-hot furnace. The chasm opens out toward St. Pierre, but the enormous columns of steam cut off the view in that direction. There were hundreds

of fumaroles all about us. What was thought to be a cone of cinders in the crater was learned in reality to be a huge pile of gigantic rocks piled up one on the other. There were crusts of sulphur everywhere, but we saw no ashes or cinders in or near the crater. The whole vast bed of the old crater and of Lake Palmiste was emitting steam through thousands of orifices.

"The ascent to Lake Palmiste is up a long and sharp incline covered with ashes. These had been soaked by the rain, and as we proceeded there were terrifying gorges full of hot, volcanic debris on each side of us. Every footstep dislodged ashes, and our footing was most insecure. There were also clouds of sulphurous smoke, through which the sunlight swept at intervals.

"The ascent was the most terrifying experience of my life, yet Professor Heilprin, the previous day, had sat enveloped in darkness on the lip of what was once Lake Palmiste, and had descended the horrible area in a thunder storm of volcanic clouds and almost complete darkness. Mr. Leadbetter was with him."

Mr. Kennan's party had previously gone through a dangerous experience. On the night of the 26th they witnessed a frightful eruption of the volcano, and another occurred on the morning of the 28th, so violent that Vive, the plantation at which they were, was declared to be untenable, and was abandoned for a location named Acier. He says :

"The 29th we spent at Morne Rouge questioning eye-witnesses of the catastrophe of May 8. The 30th we tried to ascend to the crater from this side, along the Cale Bass divide. From the crest of the divide we had a wonderful view into the awful Fallaise Valley, which was a tremendous, seething gorge of terrible volcanic activity. We were driven back by a severe thunderstorm, and very nearly lost each other in the dense volcanic clouds. We planted a

record stake at the highest point we reached, on which we inscribed our names.

‘While at Morne Rouge we saw and interrogated Raoul Sartout, the man who was rescued from the dungeon in St. Pierre, and who is the only real survivor of the city.

“On the 31st we returned to Acier, and at half past 6 o’clock in the evening Prof. Heilprin and Mr. Leadbetter came down from their splendid attempt to reach the rim of the crater. Prof. Heilprin said that he and Mr. Leadbetter had been enveloped in volcanic clouds and a thunderstorm and that they, therefore, did not reach the actual edge of the crater itself. I fully realized Prof. Heilprin’s danger the next day when we made the ascent. He is a fearless scientist, and Mr. Leadbetter also deserves the highest praise.

“On Sunday, the first of June, the five members of our party, Prof. Heilprin, Mr. Leadbetter, Mr. Jaccaci, Mr. Varian and myself, started to make the ascent. Mr. Jaccaci came down with mountain fever on the arete and Mr. Leadbetter became exhausted. They did not reach the crater. June 2 we rested and went to La Trinité, and to-day, the 3rd, we are here [at Fort de France] safe and sound.”

PROFESSOR HEILPRIN’S NARRATIVE

Though we have given the story of Prof. Heilprin’s exploit as told by others, it is not amiss to let him speak for himself. He tells us :

“I left Fort de France with Mr. Leadbetter the morning of May 29 and reached Acier at 7 o’clock in the evening of the 30th. We visited Vive and Basse Pointe. The latter place has been entirely destroyed by the overflow of the local streams. Mud flowing into the beds of the rivers there caused this overflow. Many important businesses are seriously menaced by the floods.

"May 31 we made our first ascent of the volcano. We left Acier at half-past five and Vive at half-past 7 o'clock in the morning. The party consisted of Mr. Leadbetter and myself and three colored boys. We were on mule-back. At an altitude of 700 meters we began the ascent of the arete. We passed along its east side and slightly to the north of the mountain.

"We arrived at the lip of the old crater, the former site of Lake Palmiste, at 11 o'clock. Here it began raining. Rain clouds and the clouds from the volcano enveloped us and we could not see ten feet. A terrific thunderstorm had begun, and we sat on the crater for some time, speculating whether the detonations we heard were of thunder or from the volcano. As we afterward found the river Fallaise to be boiling, the detonations were probably volcanic.

COMPASS WOULDN'T WORK

"We could not tell how near we were to the crater as, either from local attraction or the electric conditions, our compass refused to work. Its variation was about 20 degrees to the eastward, but later we found that it acted normally at the lip of the new crater. The colored boys with us were horribly scared.

"We finally groped our way down that awful arete through gloomy clouds of rain and amid great electric discharges. At every step we dislodged the rain-soaked ashes, and were in danger of being precipitated down the hideous gorges on either side.

"The extreme top of the volcano is covered with cinders, scorix, boulders, and angular rocks, which had been ejected from the crater. Further down the mountain is covered with ashes and mud, and these are thick on the arete. On our way down we saw the river Fallaise rushing along with great velocity and full of steam and of mud. We reached Acier well but soaked, caked with mud and very much disappointed.

"At Acier we met George Kennan and his party and determined to attempt a second ascent the next day, June 1. The ascent made this day with Mr. Kennan was more trying and difficult than the one I had previously made with Mr. Leadbetter. The day was intensely hot and it was raining. When we reached the old crater, I was again enveloped in vapor.

'The temperature of the basin of Lake Palmiste, taken three inches below the surface, was 124 degrees Fahrenheit. Between lifts in the clouds of vapor we could see the new crater, of which Mr. Varian made an excellent sketch. Suddenly the vapor cleared away and we made a dash forward.

"We reached the edge of the new crater, and from where we stood we could have dropped stones into the white mass within. The new crater is a crevasse running north and south, and expanding into a bowl. This crevasse nearly rifted the mountain; it runs transversely to the old crater, and might be called a huge gash. From it volcanic material has been freely erupted.

"As we stood on the edge of the crater a sublime spectacle began. I now have some conception of what is going on inside the earth, and have been a spectator of Nature's secret interior work. We were assailed with noise. Far below there was a hissing of steam like that of a thousand locomotives, as well as violent detonations.

"The principal output of the crater, while we were there, was steam. The phenomena were limited and were not essentially different from those of other volcanoes in action. Positive assurance was gained that no molten matter has flowed over the lip of the new crater. Several observations taken with the aneroid barometer showed that the height of Mont Pelee was not changed.

"I agree with Prof. Robert T. Hill, the geologist of the United States Government, that Mont Pelee has erupted no lava, and that there has been no cataclysm nor any serious topographical alterations. No cinder cone was visible in the crater; what was taken for a cone is a pile of ejected rocks. Perhaps the bottom of the new crater may contain a cinder cone, but we could see down only about 150 or 200 feet.

"I believe, however, that the crater is very much deeper than this. I do not know the exact materials of which the pile of rocks in the centre of the crater is composed, but it seems to be matter which has been ejected from the crevasse. This pile of rocks has no vent. I think Mont Pelee has freed itself from the interior pressure, and that the volcano is not liable to further violent eruption. It is not safe, however, to make predictions about volcanoes.

AN UNIQUE ERUPTION

"The eruption of Mont Pelee of May 8 was unique in that it resulted in the greatest destruction of life and property ever known by direct agency of a volcano. The phenomenon of the explosion of flaming gases is probably new, but a careful study of observations is necessary before an opinion can be reached.

"The electrical phenomena are also new. They probably did not play the chief role in the destruction of St. Pierre, but were developed by and aided the other forces. I have specimens which show the effect of the bolts of lightning. The latter were small and intense, and penetrated within the houses of the city. For rapidity of action and for lives destroyed, Mont Pelee holds the record among volcanoes.

"When we got back to Acier we found Mr. Jaccaci and Mr. Leadbetter, who had stopped on the arete and had descended

before us. Early in the morning of June 2 Mr. Kennan and his party left for Fort de France. Mr. Leadbetter and I went to Morne Rouge to study topographical details, and from there we returned to Acier and Fort de France."

We have given considerable space to the story of Prof. Heilprin's daring venture, alike from its daring character and the great interest attaching to its results. The eulogistic accounts given by his fellow adventurers might have sufficed, but his own story is so simple, modest and direct that it seemed only just to him to give it place. This is especially called for in view of the high estimate put upon his gallant achievement by Americans in general, and the position that is accorded him as one of the chief heroes of the Mont Pelee eruption. It may be said further that he is of opinion that the volcano has done its worst, and will gradually sink back into repose, with occasional outbursts, diminishing in intensity. This opinion is indicated by him in his cablegrams to the *Philadelphia Press*, the substance of which we here reproduce :

"I have just returned from a six days' exploration of Mont Pelee. A careful reconnoissance of the summit of the volcano made during the two ascents of Saturday, May 31, and Sunday, June 1, reveals that the main crater is still in a boisterous condition. Yet, though this is the situation, my examination of the actual state of things on the spot convinces me that there is no impending repetition of the earlier disaster, the outbreak that overwhelmed St. Pierre on May 8. In consequence I am pacifying the inhabitants and encouraging them to return to work, which many are already doing.

"The volcano itself is practically intact, but little changed, and vast mud-flows are the chief contribution of its craters. The great cataclysm, the absolute destruction of St. Pierre, was a catastrophe

without precedent, unparalleled in volcanic outbreaks, and the suddenness and completeness of the death-dealing agency suggest that it was probably an inconceivably violent blast of inflammable gases, with atmospheric dissociation. The correspondence between the eruptions from Mont Pelee on this island (Martinique) and the eruption of La Soufriere on St. Vincent establishes beyond question the sympathetic relation of the Antillean volcanic circuit, of which these two islands are a part, the volcanic crescent beginning at Saba and ending at Grenada.

THE ISTHMIAN CANAL QUESTION

“My study of what has happened here throws added light on the Isthmian Canal question. The catastrophism is without parallel. Its relation with conditions at St. Vincent establishes a long volcanic circuit, whose existence should dispose of Nicaragua as a canal route. The reasons which lead to this conclusion as to the canal route are these: The conditions here and at St. Vincent establish conclusively an increase, and not a decrease, of volcanic phenomena in the Caribbean Gulf region.

“An absolutely new form of destructivity has been exhibited here. The destruction has been not by lava, ash or earthquake but by explosive gases or steam, shattering everything as if blown from a cannon. For seven miles massive masonry villages have been overwhelmed in all directions by terrific mud and rock. The loss is incredible. I have visited St. Vincent, ninety miles away, and find the phenomena there identical with a broader area of destruction. There can be no question as to the interrelation of both eruptions, that at St. Vincent preceding by one day that at Martinique. The facts all prove the broad reach of volcanic force, and that reliance for the protection of a canal running through a

volcanic country like Nicaragua on the localization of volcanic force, its assumed dormancy, or the resistability of the canal to its force is absurd.

"Instead of going to Precheur to study the phenomena on the west flank of Pelee, I went over to St. Vincent to examine into the character of the eruption from the Great Soufriere, whose first outburst on May 7 was rather lost sight of in the greater disaster in Martinique on May 8. I find the phenomena attending the eruptions of the Soufriere identical with those that have been noted in Pelee's outbreaks. On my return I found Pelee again boisterous. Vast mudflows were pouring seaward down the eroded slopes, and the mountain was surrounded by a tremendous cloud of steam and ash. The volcanic disturbances causing a three-foot rise of the sea, renewed the panic and people were again in a state of great fear, but I am still of the opinion that there is no impending danger of a repetition of the earlier catastrophe."

A few words in relation to the St. Vincent volcano of La Soufriere, the rival in destruction of Mont Pelee, and we have done. This mountain seemed more inclined to sink quickly to rest than its Martinique counterpart. Steam continued to rise from its crater, with seeming fire flakes nightly, but with no strong evidence of a return of its perilous activity. In addition to Professor Heilpin, a party of scientists from Martinique visited St. Vincent and ascended the practically quiescent volcano. The party consisted of Professor Jagger, the geologist of Harvard; Dr. Hovey, assistant curator of the museum of natural history in New York, and Mr. Curtis. They were accompanied by a local planter, McGregor Macdonald.

The explorers succeeded in reaching the summit of the Soufriere from the western side. The ascent was exceedingly difficult,

owing to the mud that covered the mountain side, but the ground was cool. After a tiresome scramble up the slippery hill, the rim of the old crater was reached at about midday. There was no trace whatever of vegetation, but there had been no change in the topographical outlines of the mountain on that side, and the old crater retained its tragic beauty. The great mass of water that formerly lay serenely about 500 feet below the rim of the crater had disappeared, and the crater appeared to be a dreadful chasm over 2,000 feet deep. With the aid of a glass, water was made out at the bottom of this abyss.

The party did not venture across the summit of the Soufriere to inspect the new crater, which was then emitting a little vapor, for the ground in that direction looked dangerous. Apparently the ridge of the mountain, called the "saddle," was intact, although the old crater seemed of larger circumference than before the recent eruption. At the base of the Soufriere a subsidence of 100 feet had occurred for an area of a square mile. The bank of volcanic dust that prevented the sea from encroaching farther inland at Wallibou was being gradually washed away. The lava beds on the eastern side of the Soufriere continued to emit steam, despite the protracted and heavy rainfall that had occurred; all the indications favored the opinion that the mountain had returned to its old state of repose.

* There are 512 pages in this volume. The sixty-four full-page half-tone illustrations should be added to the last folio number (448) indicated, giving a total of 512 pages.

